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A Thousand and One Nights
Page 6

St. Pat's Ball
Page 8

Engineering Exam
Page 10

Dean Enger Retires
Page 13

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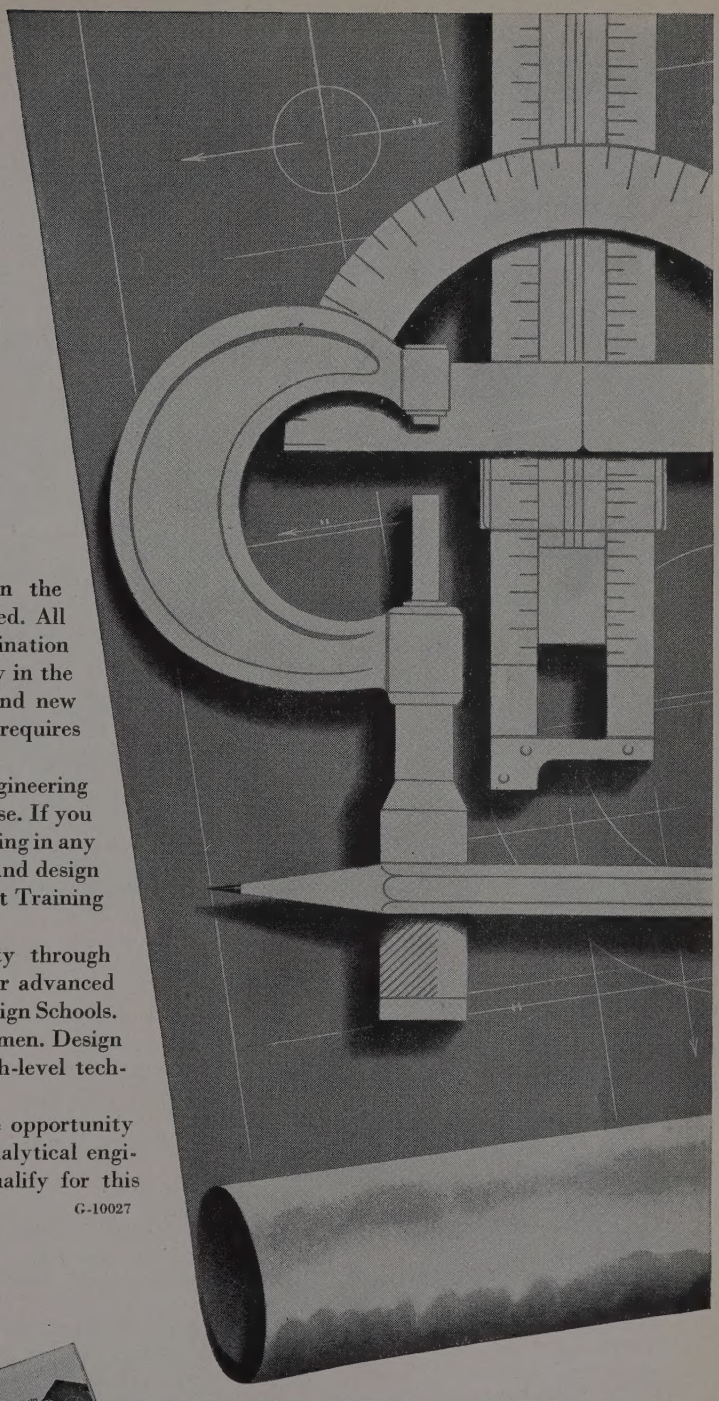

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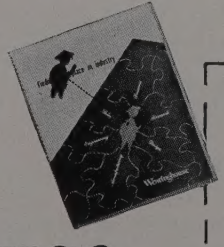

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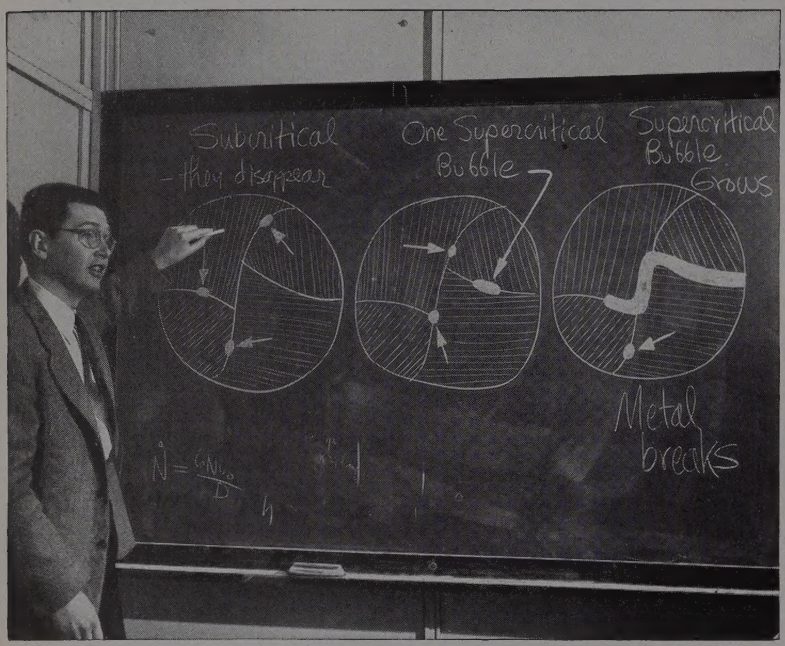
New Developments

By Leonard Ladof, E.E. '49
and Henry Kahn, Ch.E. '50



How minute cracks or "bubbles" cause metals to fracture is illustrated in sketches by John Fisher of General Electric. (Photo courtesy of General Electric.)

Metal Fracture Theory

New theories as to why and how metals break were recently announced by scientists of the General Electric research laboratory. Their investigations show that the fracture of metals begins with extremely small cracks, which act as nuclei and grow into a large split when enough tension is applied.

The nuclei, which may result in fracture, form along the boundaries between the grains or crystals of metal where the atoms in the grains are most active. The minute cracks tend to grow under tension, and if a nucleus reaches a certain critical size, it will form a complete split between grains.

Enough rapidly growing nuclei in a sample will eventually cause the sample to break.

Prior to these investigations it was usually assumed that the break in the metal occurred simultaneously through the sample. However, the new theory leads Dr. J. H. Holloman of the G. E. laboratories to predict metals five to ten times stronger than they are at the present time. "If we can find ways of preventing crack formation along the boundaries, and make the only possible break occur through the much stronger grains, we can increase the metal's strength at high temperatures."

Curved Light

A new plastic which conducts light like a garden hose conducts water has been produced by Westinghouse research laboratories.

This translucent, ember plastic is so flexible and light conducting, according to Westinghouse, that no matter how many times it is bent and even if it tied in a knot, a beam of light will shine completely through it.

Three-Dimensional Glasses

Paul H. Gesswein and Co. announced the production of magnifying spectacles giving three-dimentional views. Models which can be attached to regular eyeglass frames are also available. These glasses are especially useful for inspection of small parts and are made in long, medium and short focal lengths.

Atomic Migration

Among General Electric's most recent developments is a method of determining the speed of diffusion of atoms is metals. It is believed that the determination of these characteristics of metals may lead to "designing" metals for specific uses just as implements are now designed.

The method consists of electroplating a block of ordinary silver with radioactive silver. Then the block is heated to 500° C. for several hours; after it is cooled the block is sliced into sheets about the thickness of tissue paper. By finding the innermost radioactive sheet of silver, the speed of the silver atom within the block may be determined.

The study just completed indicates that at 500° C. the atoms which travel around grains of silver have a speed of about one-tenth of an inch per week, while atoms that travel through grains have a speed of approximately one inch in 10,000 years.

Theatre Television

An advanced optical system has made possible the television "theatre." The optical system, part of the direct projection television equipment used by the Radio Corporation of America, is the prime factor in obtaining high quality pictures 18 by 24 feet. In the direct projection system are three major elements: the special projection kinescope which is the source of the light image; the optical system which projects the image; and the viewing screen.

Although similar in many ways to the direct viewing tube used in the conventional television receiver, the kinescope produces an image of much greater brilliancy because of the higher voltage applied to it.

Elements of the optical system, based on an astronomical camera, consist of a spherical mirror and a correcting lens. The lens are made of plastic, by a cold setting process. Lenses as large as 20 inches in diameter have been made by this process.

The principal feature involved in the R.C.A. developments is the method employed to correct the spherical aberration of the system for finite focus. The shape of the lens must be such that all rays emanating from any point on the tube face and reflected by the mirror shall meet at an image point a standard distance from the correcting lens. The shape of the lens can be determined by tracing a large number of rays and evolving a final curve. Such a curve is difficult to generate and is derived by dividing the surface of the lens into any zones and grinding them progressively.

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the Illinois Technograph

Volume 64 **Number 7**

The Tech Presents

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ARTICLES

A Thousand and One Nights ---------- 6
St. Pat's Ball ---------- 8
Professional Engineering Exam ---------- 10
Dean Enger Retires ---------- 13
Employment Directory ---------- 16

•

DEPARTMENTS

New Developments ---------- 2
Vocabulary Clinic ---------- 11
Personalities ---------- 12
In This Corner—Navy Pier ---------- 14
Undercover at Galesburg ---------- 15
Technocracks ---------- 40

OUR COVER

Sue Welch and George "Mike" Mahoney smile for their public after being chosen, respectively, Queen of the Ball and St. Pat at the annual St. Pat's Ball for engineers. Sue holds the cup presented to her by Carl Falk, president of the Engineering Council. (Photo by Felix Ou.)

A Thousand and One Nights

By Connie Minnich, C.E. '51

Of the thousand and one nights that the Persian Gulf Command spent in Iran, every sunset saw the departure of more supply freights, trucks, and fighter planes from the Persian Gulf to Russia, 700 miles away over one of the most hazardous traveling routes known to exist—the Persian Supply Corridor. It was the Command's task to deliver American lend-lease supplies to the Russians as fast as they could be shipped from America.

For the Command, the famed Arabian nights of legend were filled with mud, torrential rains, malaria, flies, temperatures of 135° F, lonesomeness, and an everlasting sand that even found its way into food until the stomach was little more than a sand grit pit. Yet, in spite of calamities as bad as those of Biblical lore, the Persian Gulf Command was a key factor in the punishment the Russians were able to feed Hitler's troops in driving them back to their own borders.

Back in 1941 originated the problem of getting our lend-lease supplies through to Russia. The Black Sea entrance was blocked from the Mediterranean by Nazi occupation of Greece. American relations with Japan were on the verge of severance, which eliminated the Siberian entry. To the south, the Himalaya ranges formed a natural barrier, and to the north, German submarines patrolled the North Sea and the waters off Denmark and Norway. The least of the evils, then, was a possible supply channel through Iran, up to Russia's back door.

The routes selected belonged to the age of camels. After considerable scratching around Iran's some 628,000 square miles, Army officials decided upon two main routes: the rail travel was settled upon an 800-mile stretch of rails going from Bandar Shapur on the Persian Gulf to Bandar Shah on the Caspian Sea; the truck route followed an ancient Iranian highway 700 miles long. This road passed from Basra on the Gulf to the west of the rail route and had its terminal in Teheran, the capital of Iran.

Both rail and truck routes in their original states were outstanding enough to be classified as the eighth and ninth wonders of the world. One of the highest-priced standard gages in the world, the railway cost $160,000,000 when it was built in 1938 by the old Shah of Iran. This expenditure seemed reasonable enough when one observed the construction of the railroad. The route it followed climbed from sea level to an elevation of 7,200 feet with frequent grades of 2.8 per cent. The spiraled switchbacks and curved tunnels had few equals in the whole of Europe; and in one section of 120 miles through the mountains, the railway had 132 tunnels (amounting to 47 miles) and innumerable side-hill galleries for protection against rock slides.

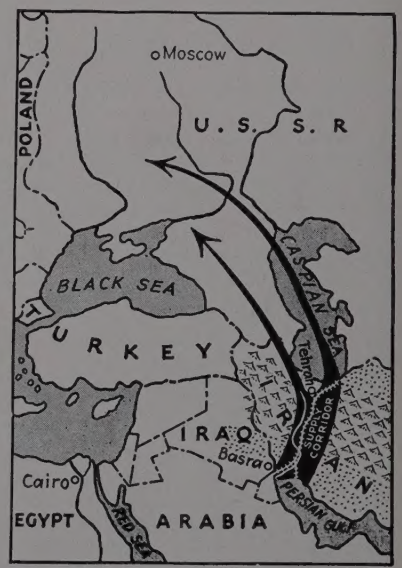
Both routes ran the gauntlet of topographic extremes. The first 180 miles out of Bandar Shapur and Basra went through desert similar to Death Valley where the shady temperature was often 150° F.; where the humidity soared to 80 per cent; where monsoon rains turned the entire desert into great stretches of lakes that disappeared only through long periods of evaporation; and where ground water was so near the surface that it oozed out of the sand even in the light impression of a foot print. The other 500 miles of the route climbed into ranges of mountains in the Luristan and Elburz provinces with their Alpine snows and Siberian temperatures.

The first detchment of the Persian Gulf Command (about 9,000 officers and men) landed in Iran in December of 1942. The first step was to transform the sleepy little fishing towns of Khorramshahr, Bandar Shapur, and Cheybassi on the Persian Gulf into full-time Liberty ship terminals complete with 40-ton tower-mounted revolving cranes and 100-ton guy-derricks. Port battalions had to be trained in dock-walloping and lighterage operations for the unloading of these vessels. These ships came in such a stream a few months later that they had to wait in line at the docks until more wharfing facilities were completed. As fast as the supplies were unloaded, they had to be packed into waiting freights or trucks for the long overland route.

In the handling of trucks and fighter planes, "C.M.T." tonnage became the most efficient method of shipment. "C.M.T." stood for Cased Motor Trucks and referred to trucks that were shipped piecemeal in cases to be assembled at the ports upon arrival. For this purpose General Motors established two large truck assembly plants, one at Khorramshahr and the other at the inland town of Andimeshk. In the usual procedure, the parts of the truck would arrive in four cases which, after unloading, were broken open and the parts assembled, tested and inspected. The finished product would then roll back to the supply dumps on its own four wheels, load up with other supplies, and be off on its way to Russia the same day it arrived. Staffed with native labor, these two assembly plants turned out an average of 7,500 vehicles a month when the Russians were asking for 200. These vehicles not only included trucks, but also covered jeeps, command cars, half-tracks, ambulances, weapon carriers, and even fire engines.

The same technique was also employed in the assembly of fighter planes. P-39 Airacobras, P-40 Warhawks, and B-26 Mitchells with their white star insignia changed to red were turned out of the airplaine assembly plant by the thousands. A-20 light bombers were flown in from America and turned over to Russian fliers who were waiting at P.G.C. air bases to fly them immediately to European combat zones.

During the first few months of P.G.C. operation, most of the overland hauling was done by freight train since



—Photo courtesy of McGraw-Hill

The route of the Persian "supply corridor" American Army engineers.

the truck route was in no shape for decent travel. Before the route was rebuilt by Army engineers, the surfacing was in such a bad condition that the Motor Transport corps practically became a suicide unit of the Army. The intense heat of the desert, the jagged cliffs and terrific cold of the mountains and bandit hordes took an alarming toll of lives before repairs were made. So rough and full of holes was the roadbed that gasoline tanks being jarred off by the bumping were an hourly occurrence, and drivers would frequently steer their trucks while standing on the running board to escape the jouncing.

At one time or another you've probably heard the poets and romanticists baying about Iran, "land of romance." For a different slant on the story this article pays tribute to the Persian Gulf Command, one of the key factors in Russia's fight against Germany. The P.G.C. saw little of the famed Arabian thousand-and-one nights that were not filled with rain, heat, knee-deep mud, and gritty sand.

The first 180 miles of the truck route was over pure desert, where the land was so flat that the slope was less than six inches to the mile. The standard road as given by Command specifications called for a 24-foot wide slab raised 18 inches above the desert floor with a three-inch wearing surface. Large side ditches warded off to a certain extent the danger of flash floods which were a freak and frequent occurrence on the Iranian desert in the early spring. The road-building operation was accomplished by several outfits, each comprised of four close-traveling units: an elevating road-grader in the ditch; a patrol grader on the embankment to level out the discharge of the belt; water-distributor trucks to wet down the subsurface; and sheepsfoot rollers to compact the layer. The asphalt wearing surface was achieved by the addition of asphaltic oil to the top layer and, then, final compaction.

The road-building was accomplished at the rate of two miles a day. Then, one day when the construction crews were in sight of Andimeshk, the terminal of the desert road and the end of the drudgery, the "impossible" happened. Although it was a clear day without wind, water suddenly appeared on the horizon, and without warning, rapidly and efficiently washed out the last 30 miles of road. Three-foot waves created by a sudden wind kept beating upon the stretch until not a telephone pole or culvert was left standing. A day later, the whole area was a large lake some 250 square miles in area. A subsequent investigation showed that a nearby river had undergone some geological disturbance causing an overflow. The P.G.C. engineers, however, will never be quite convinced that the flood was not something akin to a Biblical calamity.

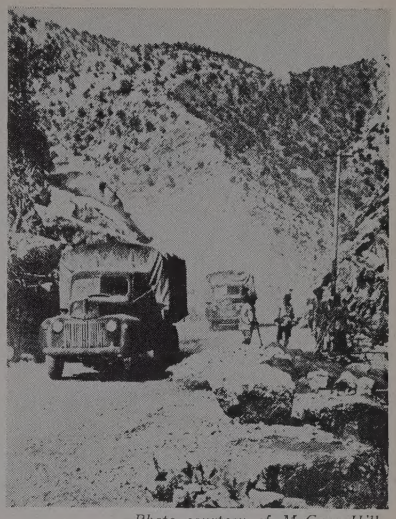
Until the Military Railway Service of P.G.C. acquired a fleet of Diesel engines, the freight locomotives used were "mikes," an old design of engine that was suitable for Iranian peacetime travel, but hardly serviceable for the round-the-clock rail schedule that the Command required. The "mikes," used only for light passenger travel, were unequipped with air brakes for the mountain-climbing. Whenever one of these engines went through one of the 220 tunnels on the train route, the crew had to slow it down to a crawl and get out and walk beside the train because the engine steam packed the tunnel until the mercury hit 180° F. Unlike the United States, there is no Iranian law requiring tunnel ventilation, so that going through these tunnels was justifiably called "charging the ratholes."

The arrival of Diesels eliminated most of these hazards. They traveled through the tunnels without a degree temperature change, and their powerful brakes stopped the monthly occurrences of runaway trains.

Despite the heat, cold, sand and bandits, the worst of the P.G.C. enemies were the Iranian versions of the Texas mosquito and the Iowa fly. The method of water purification was another example of a necessary combination of the modern and the ancient in a land in which Waldo Bowman, *Engineering-News Record* war correspondent, observed, "has a native population that regards water courses as combination latrines, laundries, bath tubs, and drinking fountains."

The most effective treatment was given, oddly enough, by the practically obsolete slow-sand filter. Needing few valves and pipe fittings, which were at a minimum in Iran at the time, some of the treatment plants had a daily capacity of 400,000 gallons. In other cases, pressure filter units, tanks four or six feet in diameter filled with filter stones, were used. These filtering operations cut down on the heavy chlorination that otherwise would have been needed to entirely eliminate the prevalent amoebic dysentery.

The water supply for the capital city of Teheran arrived from the mountain in a system of *ghanats,* supply lines built on the Roman aqueduct principle. The *ghanats,* however, were a network of underground tunnels rather than the large superstructures of the aqueducts. They were laboriously hand-mined by native labor crouching and crawling through the underground. At Teheran, several of these *ghanats* are directed together in a flume from which steel pipes take the water to the treatment plant for chlorination and filtration.



—Photo courtesy of McGraw-Hill

The engineers' roads opened the way for transportation and communication.

Malaria control was effected by the constant treatment of still pools of water, ditches, and other possible breeding places for mosquitoes. Oiling and dusting with Paris green were the operations performed by native labor for a radius of three-quarters of a mile around P.G.C. camps and zones. The three-quarters of a mile limit was taken as the flying range of *anopheles stephansi,* the most common breed of mosquito. In one case, an officer made a game of malaria control for a large group of ten- and twelve-year-old boys. Under his direction, an "army" of boys "charged" the huts of native labor settlements with Paris green spray guns and sprayed the entire contents of the house, including the occupants. Tenants as well as the boys enjoyed the game and the only sufferer was the mosquito.

While the Iranian natives, steeped in their ancient cultures, gazed in awe at the monstrous cranes, derricks, planes, graders, and tractors that a modern industrial company brought with them to accomplish their bustling noisy business, it became P.G.C.'s turn to stare at the practical but ancient methods of building construction in this torrid land. Try as they would, Army engineers could not equal the native fabrications of mud bricks, straw roofing, and "bally pole" trusses.

Buildings constructed by these methods gave long and serviceable wear. There was certainly no scarcity of materials. Mud bricks were simply slabs

(Continued on page 36)

St. Pat's Ball . . .

By Bill Soderstrum, Cer.E.'52

For the second year in succession Dick Cisne entertained the engineers with his music at the annual St. Pat's Ball. On Saturday, March 5, Huff gymnasium was crowded with 650 engineers and their ladies.

The dance floor was bordered with displays from all the engineering societies and the Technograph. As usual, these displays were the center of attraction during intermissions and proved to be very entertaining. Some of the more interesting displays included a Link trainer furnished by the I. A. S., a Kiss-o-meter which was one of the features of the A. I. E. E.-I. R. E. display, and the bottle of "heavy milk" which made up the display for A. I. Ch. E.

The two most popular displays were those of the A. S. M. E. and S. B. A. C. S. The former display featured various types of gears and heating units. The most attracting part of the display, however, was the lathe used to cut brass rings for the ladies' fingers from a solid brass rod.

The S. B. A. C. S. display, voted best and most informative, included various raw materials and the different ceramic products into which they are made. The highlight of the display was a series of plates showing the steps in the process of enameling. The plates were approximately three inches by four inches and were coated with a white enamel. On the surface of this enamel was placed a green enamel shamrock with the words "St. Pat's Ball" above it. The finished product was presented to each couple as a souvenir of the dance.

Entertainment during one of the intermissions, introduced by Master of Ceremonies Bill Bierbaum, was furnished by the "campus characters," Jim and Jerry Sedgwick, Dave Johnson, and Bob Black. The quartet rendered their versions of "Home Sweet Home" and "Clancy."

George "St. Pat" Mahoney, Sue "St. Patricia" Welch, and their courts were introduced by Carl Falk, president of the Engineering Council and chairman of the ball. The queen's crown, the traditional North Campus novelty, was made by Joan Hessler.

Queen Sue Welch, George "St. Pat" Mahoney, and their court pose with last year's winner, Alvina Sorzickas, at St. Pat's Ball. (Photo by Felix Ou.)

An interested audience watches brass rings turned out on a turret lathe in the M.E. department's exhibit (left). Engineering training pays off; the Kissometer thermometer boils over in the E.E.'s exhibit (right). (Photos by Felix Ou.)

The dance floor of Huff Gym is packed with couples dancing to the music of piano-playing maestro Dick Cisne. (Photo by Felix Ou.)

Professional Engineering Exam

Edited by Philip Doll, M.E. '49

"In order to safeguard life, health and property, any person practicing or offering to practice professional engineering is required to submit evidence that he is qualified so to practice and to be registered as hereinafter provided." Thus is stated the purpose of the Illinois Professional Engineering act in Section I of the act.

The examination, consisting of three parts, for registration under this act is frequently given at the University. Parts I and II of the examination will be offered on May 24, 1949, and part III on May 25, 1949. Seniors may take only the first two parts now, and must wait at least four years after graduation to take the last part.

As a guide, in preparation for this examination, a sample of the questions asked last fall is presented below. Only a specified number of questions from each of the three parts must be answered, allowing considerable latitude in choosing familiar material. As may be noted, one of the advantages in taking the examination as a student is that a large amount of the subject matter covered has been recently studied and is still fresh in the student's mind. Certain reference books and hand books are permitted.

PART I

1. Given the equation of a curve as

$$y = x - x^2/240$$

(a) Plot the curve in the interval $x = -120$ to $x = +240$.

(b) Write the equation of the tangent to the curve at $x = -120$.

(c) Write the equation of the tangent to the curve at $x = +240$.

(d) Calculate the area between the curve and the tangents.

2. A body when submerged in an oil having a specific gravity of 0.80 weighs 16 lbs. and requires a downward force of 20 lbs. to keep it submerged in a liquid (acetylene tetrabromide) having a specific gravity of 2.96.

(a) What is the volume of the body?

(b) What is the weight of the body?

(c) What is the specific gravity of the body?

3. A closed tank standing in a vertical position has an inside diameter of 6′-0″ and an inside length of 20′-0″. The tank has flat ends. A pipe leading from a source of water supply is connected by means of a valve to the bottom of the tank. The water surface in the source of supply is open to the air and 120 feet above the bottom of the closed vertical tank. With the valve closed and the tank empty a pressure gage in the top indicates a pressure of 5 psi, when the temperature of the air in the tank is at 60° F. If the temperature of the air in the tank remains constant:

(a) When the valve is opened how high will water rise in the tank?

(b) What pressure will the gage in the top show?

(c) Assuming the air to be dry, how many pounds of air will the tank contain?

4. One tank contains 5 pounds of air at a gage pressure of 50 psi and a temperature of 120° F. A second tank has a volume of 20 cu. ft. and contains air at 40° F and 20 psi gage. If some time after the tanks are connected, the temperature is found to be 80° F.:

(a) What will be the pressure in the two tanks?

(b) How many pounds of air remain in the first tank?

5. A steel sphere rolls 120 feet down an incline having a slope of 1 foot vertical to 3 feet horizontal. The incline down which the sphere rolls is connected by a smooth transition curve to an upward incline having a slope of 1 vertical to 1 horizontal. Neglecting friction:

(a) If the sphere starts from rest what will be its speed at the bottom of the incline?

(b) How far will it roll up the second incline?

6. The electrical resistances in ohms of two coils of wire, one manganin and one copper, at the temperature t, (degrees centigrade), are given by:

$$R_C = 1.8\ (1 + 0.00393t).$$

(a) Find the horizontal intersection of these lines.

(b) What is the physical significance of this point?

7. Twenty cubic feet of air at a pressure of 25 psi abs. and temperature of 60° F. is compressed adiabatically until its temperature is 200° F.

(a) What is its final volume?

(b) What is its final pressure?

8. Chlorine gas containing 3.6 per cent oxygen is flowing through an earthenware pipe. The gas is measured by introducing into it air at the rate of 150 cubic feet per minute and further down the line, after mixing is complete, removing a second sample of gas for analysis. The gas is now found to contain 9.6 per cent oxygen. How many cubic feet per minute of the initial gas were flowing through the pipe?

9. Calculate the exact length of a tight belt to connect two pulleys 7′-0″ and 3′-0″ in diameter respectively, the centers of which are 8′-0 apart.

10. (a) Describe briefly the manufacture of soap.

(b) Name the important by-product of this process and give a use of it.

(c) Write a formula that represents each of the following:

(1) Alcohol.

(2) A carbohydrate

(3) An ester

(4) A hydrocarbon.

(d) Write the structural (graphic) formula that represents:

(1) Propane

(2) Benzene

PART II

1. A rectangular channel 30 feet wide by 14 feet deep is closed at one end by a bulkhead in which there is a rectangular orifice 1′-6″ high by 12′-0″ wide, the bottom of the orifice being 1′-0″ above the bottom of the channel. Water in the approach channel is maintained at a depth of 10′-6″ above the bottom, and flows through the orifice into an outlet channel. The bottom of the outlet channel is at the same elevation (at the bulkhead) as the bottom of the approach channel, and water in the outlet channel is maintained at a depth of 4′-6″ above the bottom. The outlet channel is 30′ wide.

(a) How much water flows through the orifice into the outlet channel?

(b) What is the average velocity in the approach channel?

(c) What is the average velocity in the outlet channel?

2. Oil is being pumped from a truck to a tank 10 feet higher than the truck through a 2-inch galvanized pipe line 100 feet long. If the pressure of the discharge side of the pump is 15 psi, at what rate in gallons per minute is oil flowing through the pipe? The oil has a kinematic viscosity of 0.001 sq. ft. per sec. and a specific gravity of 0.92 at the temperature in the pipe.

3. An overhead crane which is to have a full load capacity of 50 tons is to be designed for a bridge travel speed of 250 feet per minute. The weight of the crane itself in ready-to-operate condition, will be 150,000 lbs. For the purpose of this problem it may be assumed that a force of 40 lbs. per ton of total load is required to overcome all mechanical and electrical resistances and maintain the bridge travel speed of 250 feet per minute.

The problems appearing in this article were taken directly from the "Illinois Professional Engineering Examination for Registration" given November 9, 1948.

They should prove to be an excellent exercise for those student senior engineers planning to take the next examination to be given on May 25.

(a) What horsepower motor will be required for bridge travel?

(b) If the bridge is to reach its travel speed of 250 feet per minute under full load in 7½ seconds, what overload must the travel motor be capable of exerting?

(c) In what distance will the bridge reach its maximum travel speed of 250 feet per minute?

(d) If the crane under full load is to be brought to rest from full speed in 10 seconds, how much energy will the brakes have to absorb and what will be the stopping distance?

4. The end truck for the crane of the previous problem has four wheels spaced 5′-4″, 3′-8″, and 5′-4″. Under maximum load each wheel brings to the rail a load of 45,000 lbs. The runway beams on which the crane travels have a length of 30 feet between supports.

(a) Where should the wheels be placed to produce maximum moment in a runway beam and how much is the moment

(b) Where should the wheels be placed to produce maximum shear in a runway beam and how much is the shear?

5. A 3-phase, 440 volt, 60 cycle, 4 pole induction motor drives a pump with an output of 50 hp. The efficiency of the pump is 80 per cent, while that of the motor is 90 per cent. The motor power factor is 88 per cent lagging, and the slip is 3 per cent. Determine the *torque* delivered by the machine and the *line current* to the motor.

6. A certain 230-volt d-c shunt motor whose armature resistance is 0.07 ohms, including brushes, generates a torque of 250 lb.-ft. at 1200 rpm with an armature current of 210 amperes. Calculate the torque developed when the armature current is 300 amperes and the field is reduced to 75 per cent of normal.

7. (a) A tractor is to have a drawbar pull of 5000 lb. The differential has a double-threaded worm acting on a wheel having 35 teeth. The rear wheels are 42 in. in diameter. The motor has a maximum torque of 200 lb.-ft. The efficiency of the drive is assumed to be 90 per cent. What gear ratio is necessary in the transmission?

(b) Calculate the stress in the rear axle if the diameter is 1.75 in.

8. Calculate the volumetric efficiency of a Diesel engine from the following data: per cent of CO_2 by Orsat 6; bore of engine cylinders 4¼ in.; stroke 6 in.; number of cylinders 6; rev. per min. 1200; temperature of air at intake 60° F.; pressure 30 in. Hg.; weight of fuel burned per hour 17.3 lb. Assume the per cent of CO_2, if all the oxygen were perfectly combined, to be 14.8. Assume that 14.8 per cent of CO_2 indicates an air-fuel ratio of 15 by weight.

9. A 3-phase, 3-wire, 208-volt, 60-cycle system draws 10 kw. at 80 per cent power factor, lagging. It is desired to connect three capacitors in delta across this line to raise the power factor to 90 per cent lagging.

10. A compound beam is composed of 20″ I at 65.4 lbs. in a horizontal position fastened through its web to the top flange of a 36″ WF at 160 lbs. and a 15″ channel at 33.9 lbs. (flanges down) fastened through its web to the bottom flange of the 36″ WF. The compound beam is symmetrical about the center line of the 36″ WF. The beam is 40 feet long between supports and is loaded over its entire length with 6500 lbs. per foot including its own weight.

(a) What is the maximum intensity of stress in compression and in tension?

(b) What is the shear per inch of length between the 20″ I and the 36″ WF at the end of the span? Between the 15″ channel and the 36″ WF at the end of the span?

11. A 30″ WF beam has a span of 50 feet between supports and is simply supported. It has a load such that the intensity of stress in the extreme fiber at the center of the span is exactly 20,000 p.s.i.

(a) What should be the stress in the extreme fiber at the center of the span of a 20″ WF beam, having the same span and the same load, so it will have the same deflection at the center of the span as the 30″ WF beam?

(b) If the load is uniformly distributed over the entire length how much is the deflection at the center of the span in inches?

PART III

Group A

1. State in approximately 200 words why you believe you are qualified for registration as a professional engineer in Illinois. Illustrate briefly by describing some engineering project or accomplishment for which you are responsible.

Group B

1. A syndicate wishes to purchase an oil well which, estimates indicate, will produce a net income of $200,000 per

(Continued on page 22)

VOCABULARY CLINIC

Remember, you won't be able to use these words until after you have consulted the dictionary for their pronounciation. From the group of words at the right, select one whose meaning closely resembles the word on the left. Answers will be found on page 38.

1. Acquiesce—(a) impede, (b) agree, (c) imply, (d) resent.
2. Quiescent—(a) unruly, (b) greasy, (c) motionless, (d) quickly.
3. Terpsichorean—(a) dancing, (b) ancient, (c) physiognomy, (d) dinosaur.
4. Approbation—(a) approval, (b) investigation, (c) trial, (d) doubtful.
5. Improbity—(a) improbability, (b) treachery, (c) integrity, (d) humorous.
6. Turpitude—(a) depravity, (b) innocence, (c) sluggishness, (d) enthusiasm.
7. Perseverance—(a) perplexity, (b) temperance, (c) determination, (d) irresolution.
8. Commiseration—(a) submission, (b) sympathy, (c) distress, (d) horror.
9. Refutation—(a) compensation, (b) distinction, (c) approval, (d) vindication.
10. Usurp—(a) devour, (b) seize, (c) repetition, (d) force.
11. Fastidious—(a) starve, (b) hasty, (c) indifferent, (d) squeamish.
12. Sibilant—(a) hissing, (b) ill, (c) self-important, (d) secrecy.
13. Phlegmatic—(a) deliberate, (b) explosive, (c) foreboding, (d) exacting.
14. Rejuvenate—(a) reinvigorate, (b) rejoice, (c) disinfect, (d) purify.
15. Facetious—(a) witty, (b) fatuous, (c) facial, (d) pernicious.

Introducing . . .

By Robert Lawrence, E.Phy. '51

STANLEY FELDMAN

The Illini baseball team will be on the march this spring, and Stanley "The Whip" Feldman will be providing plenty of spark from the mound.

Stanley has his heart in baseball and has earned his position as number one pitcher for the Illinois nine. His nickname, "The Whip," was given to him by Ruck Steger two years ago, because Stanley throws a terrific fast ball. Stan's past record in sports is excellent. He attended Farragut high school in Chicago where he was voted All-Sectional in basketball, and he was also a member of the Farragut baseball squad.

Stan made a fine showing on the Illini nine last spring. He pitched nine games and was accredited with eight wins and one loss. He pitched a four-hitter against Northwestern, but the best game he ever pitched was a shut-out against Purdue.

He remembers his greatest thrill as the Ohio game. It was the last Big Nine game and we were tied with Michigan. To lose that game would have meant a broken tie and Michigan would have captured the crown, single handed.

Stanley's big thrill came in the first inning. He found himself in a tight spot. The bases were loaded with no outs. The fourth batter popped up to the catcher to provide the first out; then Stanley opened up with his fire ball. He struck out the next two batters to retire the side, as the Illini fans went wild with cheers for "The Whip."

Stanley has received several offers to play professional ball this spring. He plans to accept one of them soon after graduation.

If professional baseball doesn't satisfy, he will enter the field of electrical engineering. Stan is tops as a student as well as an athlete. He maintains a high scholastic average of 4.4 in the College of Engineering.

Although seemingly quiet, Stanley has a nice personality and is active about the campus. He is a good looking fellow, standing six-feet-one and weighing 175 pounds, and is considered a valuable player in intramural basketball by his fraternity brothers of Alpha Epsilon Pi. He is a member of the Tribe of Illini, Ma-Wan-Da, and a mathematics honorary, Phi Mu Epsilon.

A short review of Stanley Feldman's record in scholarship and athletics shows that he is well prepared to find a good future in baseball or electrical engineering.

—Photo by C. M. McClymonds

STANLEY FELDMAN

EDWARD A. BOLDEN

The Institute of Traffic Engineers is working on a new and special curriculum for traffic engineers this semester. They feel that a special curriculum would improve the present method of picking option courses in traffic engineering from the general engineering curriculum.

Past president of I.T.E., Mr. Edward L. Bolden, states that at present the new curriculum is under development by the I.T.E. members only; but they are trying to arouse the interest of their professors to support the plan and put it into operation.

Mr. Bolden was born in the state of Texas and spent his early years at El Paso. In 1940 his parents moved to Lone Wolf, Oklahoma; but he returned to Fort Worth, Texas, for his high school education.

He graduated from high school in 1944 with a scholarship to the Hampton Institute in Virginia, and enrolled there that fall to study architectural engineering. At the end of one year, he decided that he was not in a field relating to his interests and transferred to the University of Illinois to study traffic engineering.

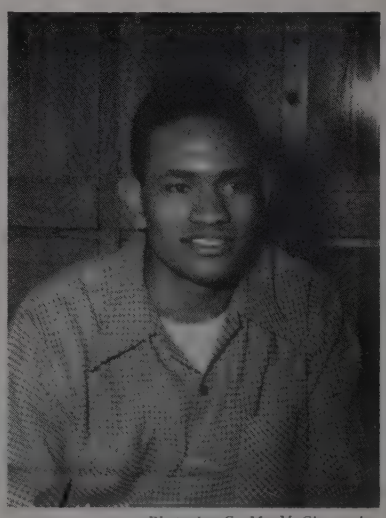
Mr. Bolden has taken several highway courses in our engineering curriculum, majoring in structural work. He attended the first University-operated summer camp for civil engineers at Blackduck, Minnesota, in 1946. It was an old C.C.C. camp, now being leased by the University for study and actual field work in surveying.

In the summer of 1947, Mr. Bolden experienced a change in study. As a member of the R.O.T.C. advanced air corps he received six weeks of training at Chanute Field, Rantoul, Illinois. Some of this training consisted of flying time in C-47s.

Last summer Mr. Bolden was able to gain some actual experience by working for the highway department at Ottawa, Illinois. This June he expects to graduate; and if he is not drafted, he has big plans of working in a foreign country. An oil company in Arabia seems to be the center of his interest. They have offered him a colorful opportunity abroad on a two-year contract; and if he accepts, his assignment will cover the engineering phase of pipe line laying and surveying.

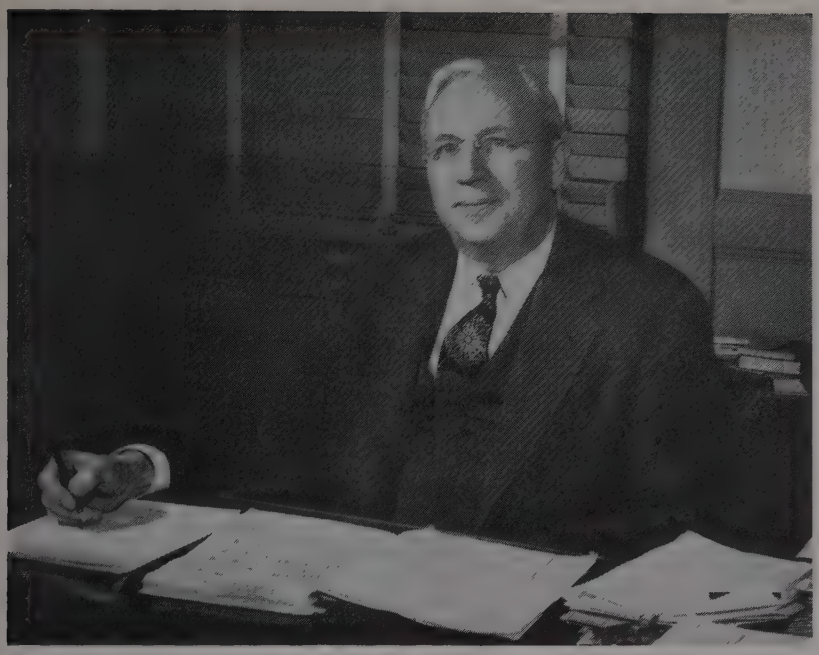
Although a very pleasant conversationalist, Mr. Bolden seems to maintain a serious attitude toward his work and future, and he finds very little time to devote to outside activities. While in high school, he served on the student council and was appointed presiding officer of his senior class. He joined a local fraternity, Omega Sigma Chi, while at the Hampton institute; after he came to Illinois he became a member of Phalanx, our honorary military fraternity.

He is not asking for any great miracles after he graduates. He merely wants to live comfortably and earn a regular income. A man of Mr. Bolden's ability should find it relatively simple to reach such a goal.



—Photo by C. M. McClymonds

EDWARD A. BOLDEN



DEAN MELVIN L. ENGER

DEAN ENGER RETIRES

By Robert Lawrence, E.Phy. '51

Upon the completion of 42 years of faithful service to the University of Illinois, Melvin Lorenius Enger, dean of the engineering college, will formally retire Thursday, September 1, 1949.

In recognition of his splendid record of untiring devotion and service to the University, a farewell banquet will be held May 5 in the Illini Union ballroom. The event will be sponsored by fellow faculty members, friends, and students. Following the banquet, a reception will be held at which time a large portrait of Dean Enger will be unveiled. The sponsors are having the portrait made for the purpose of having it placed on a wall of a corridor in Engineering hall.

Dean Enger well deserves such a tribute. Under his counsel, leadership, and direction, the College of Engineering has grown and expanded to a position of great esteem among the engineering colleges in the United States.

Talbot laboratory was built while he was head of the department of theoretical and applied mechanics. Since his appointment to Dean of the engineering college, four new buildings have been added. They are the sanitary engineering building, the physics research laboratory, the new electrical engineering building, and the new mechanical engineering building. Being director of the C.A.A. student pilot training program in 1942, he contributed a great deal of time and effort towards the promotion of the University airport.

Dean Enger has acquired the respect of his colleagues for his research in engineering mechanics and hydraulics. He has always been considered an unusually good teacher, a capable administrator, and a generous contributor to educational and technical literature. He is joint author of two bulletins of the Engineering Experiment Station.

The result of tests made by Professors M. L. Enger and A. N. Talbot in 14 water columns, representing the principal types employed in American railway practice for supplying water to steam locomotives, were summarized in one of the bulletins. The information developed in such tests enabled manufacturers to re-design their water columns, making them more efficient, thereby reducing the delay to locomotives and the cost of water services.

Other topics of his research included the study of transmission of pressure in granular materials, penstock design, and air inlet valves for hydraulic pipe lines. His research work and study have made him a well known authority in engineering mechanics and hydraulics, his field of specialization.

In 1940, Dean Enger was awarded the John M. Goodell Award by the American Water Works association. The award is made annually by the association to the "member who has made the most notable contribution to the science or practice of water works development." Dean Enger and T. H. Wiggin, New York City consulting engineer, each received engraved certificates and a monetary award for their article, "A Proposed New Method for Determining Barrel Thickness of Cast Iron Pipe." This article was published in the May, 1939, issue of the American Water Works association journal.

Dean Enger is a good scholar and prepared thoroughly for his field of work. He entered the University of Minnesota in 1900 and stayed two years. The following two years he taught in a public school. In 1904 he entered the University of Illinois, receiving his bachelor of science degree in civil engineering in 1906.

He went to work on his first job as an instrument man for the Chicago, Milwaukee, and St. Paul railroad.

The following year the late Professor A. N. Talbot appointed him instructor in mechanics and hydraulics. Within the next three years he received his civil engineering and master's degree, and in 1919 was appointed professor. He was appointed head of the department of theoretical and applied mechanics in 1926; and, eight years later, he was named Dean of the college, succeeding A. C. Willard who was moved up to the presidency of the University. He also was in charge of research investigations in engineering in engineering materials and director of the University's Engineering Experimental Station.

Dean Enger has been very active in a large number of engineering organizations, being a past president of the Illinois Society of Engineers, chairman of the Illinois section of the American Waterworks association from 1930 to '31, vice president of the Society for the Promotion of Engineering Education from 1938 to '39, and honor member of the Illinois Society of Professional Engineers in 1948. He also was chairman of the engineering section of the Association of Land Grant colleges and universities, past president of the University Club, and has served on the board of directors of the American Society of Civil Engineering since 1932. He maintains membership in several social and honorary fraternities such as Sigma Xi, Tau Beta Pi, Sigma Tau, Mu San, Chi Epsilon, and Triangle. Other organizations include the Newcomen Society, A.A.A.S., and the American Society for Testing Materials. He served as an Urbana alderman from 1919 to 1922, and

(Continued on page 38)

In This Corner... NAVY PIER

PIER FACULTY

By Robert Groemling, L.A.S. '52

DR. JOHN J. CORLISS

The Technograph would like to introduce to you another member behind the academic curtain. Dr. John J. Corliss is an associate professor of mathematics, chairman of the division at Navy Pier, and co-author with Winifred Berglund of a new, more understandable trigonometry textbook. The most striking feature of this text is its departure from the more conventional by providing four introductory chapters giving the basic ideas before the appearance of right triangles. The virtue of the book is that it gives a very thorough explanation of the material. A previous book is an analytic geometry text which is co-authored by Messrs. I. K. Feinstein and H. Levin, also of the Pier faculty.

Although Dr. Corliss' life has revolved around mathematics, he has an interesting and varied background of education and teaching. He was born and attended school in White Haven, Tennessee, and later the University of Mississippi. Incidentally, he never did graduate from high school. He was admitted to college by examination.

At Mississippi, he was very active in extra-curricular activities. To mention a few, the Honor society, Literary society, and newspaper. He worked his way through his second year by tutoring students in mathematics at the rate of twenty-five cents an hour. He netted two hundred dollars that year which meant a lot of tutoring. Dr. Corliss studied both engineering and liberal arts subjects and received his B.A. in '25 and M.A. in '27.

After this he spent two years at Texas Christian University where he taught mathematics and engineering courses. During his spare time he watched the "horned frogs" play football.

He was an instructor of mathematics at the University of Michigan from '27 to '33 while he worked on his Ph.D. Here he did research in the deflection of a coil spring due to a horizontal thrust. Dr. Corliss is a member of Gamma Alpha and Sigma Xi, scientific honorary fraternities.

Before coming here to head the mathematics department at the Pier, Dr. Corliss was head of the mathematics department and founder of the graduate school of mathematics at DePaul university.

Gardening takes up a great deal of his spare time now, but fishing and most outdoor activities, including the work done around his home keep him fairly busy.

Although Dr. Corliss through his books has made mathematics courses easier to understand, there still remain the difficult problems of mathematics everpresent to the engineers of tomorrow.

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Engineers at the Pier

Quite a few changes have taken place here at the Pier of late. The chief innovations are the birth of the Engineering Council and the St. Pat's Ball which they are sponsoring. The engineers have all greeted the latter affair with much enthusiasm. Arrangements are still being made, but tentatively speaking, it will be held at the Edgewater Beach Hotel, March 18. By the time this issue appears, the St. Pat's Ball will already have taken place.

This awakening of the engineers is an innovation in itself. Formerly, they have been content in struggling with their studies, and for the most part, being seen and not heard. Within the past few months, however, the engineering societies have strengthened their ranks and sponsored small dances and smokers of their own.

—Photo by J. V. Tullis

DR. JOHN J. CORLISS

There is a time and place for everything. An exhuberance of social activities would eventually prove to be detrimental to the studies of the engineer. In addition, our campus, situated as it is in Chicago, offers innumerable forms of amusement and pleasure for the student during the week-ends.

However, we do believe that an engineer should participate in at least one extra-curricular activity. He should seek his individual engineering society and join in the fun. There is much to be gained from such participation and you do not realize the importance of such a group until too late.

Although many engineers have arisen from this lethargic state, there still remain a great number that do not join in these informal gatherings with people of common interest. This is especially true of freshmen. College life lasts a brief four years, and since two are spent here at the Pier, there is no reason why these years should be deprived of friendly, social activities with your fellow engineers.

Let's take notice engineers, and join now!

Engineering Organizations

By Bob King, C.E. '51

A.S.M.E.

During the lull between semesters, this organization sponsored four field trips. On January 26th, the boys were conducted on a tour of the Chicago Hardware and Foundry Co. at North Chicago, on January 28th, the Hills McCanna Co., on February 1st, the Crane Co., and on February 3rd, the Continental Foundry and Machine Co. All four tours were well attended.

A mid-semester dance was held on Friday, January 28, at 8:30 to 12:30 in the third floor lounge. It was intended as a "good-bye" to the boys going down-state, and as a "hello" to the new M. E. students. There were 42 couples present to enjoy the dancing, conversation, cokes, ice cream, and "brownies."

At the first meeting of the spring semester a new vice president and treasurer were elected. The results were not available at this writing.

(Continued on page 20)

Undercover at...

GALESBURG

A Visit to Keokuk Dam

In the bright, blustery dawn of January 6, about 60 representatives of our engineering department boarded two chartered buses and journeyed 85 miles to Keokuk, Iowa. The object of this field trip, sponsored by the Engineering Council, was to furnish our engineering students with some visual knowledge of the construction and operation of the Keokuk dam and power plant, which is dam No. 19 of the Mississippi flood and navigation control project system.

With a slight feeling of misgiving on our part, the buses rolled carefully over Keokuk's antiquated toll bridge, negotiated some hairpin curves, and pulled into the employees' parking lot at the entrance to the dam site. On our half mile walk to the power plant we passed a cavernous drydock which was occupied by two barges being repaired, the locks, which were then idle as they always are during the winter months, and the unused foundations for an extended power plant which was never needed. When we entered the power plant we signed a paper waiving the Union Electric company from any responsibility for accidents, and entered an elevator, five at a time, that took us to the upper floor.

Here, with 20 students to a guide, we started our tour. The first stop was the control room, the brain and nerve center for the control of the 180,000 horsepower capacity of this famous dam. In this room there are four control cabinets and panels which are covered with a maze of gauges and switches. Some of these instruments indicate the speed and output of each generator, the height of the river at strategic points, wind velocities, and other information needed for the economical management of such a variable source of power.

Exploring this top floor further we found 110,000 volt circuit breakers, transmitters, repair rooms, and storage rooms for replacement parts.

We returned to the first floor via a steel stairway where we found the means by which the gates of the almost mile long dam are raised. It is a crane mounted on a railroad car. Two sets of tracks run the entire length atop the dam so that the crane can move from gate to gate. Early winter is a time of low water so none of the gates were open. The flow of water must be carefully regulated to prevent severe shortage of electricity during low water and to prevent floods during high water stages.

Also on this first floor is the generator room housing 15- 9,000 KVA generators. They generate, on the average, enough current in one day to operate an electric iron for 250 years. These generators (four are 60 cycle ones running at a speed of 62 revolutions per minute and the rest are 25 cycle ones with a speed of 57.7 revolutions per minute) operate with an oil pressure of 140-180 lbs. per sq. in. and are regulated by a fly ball mechanism. Turning each generator from below is a reaction type turbine receiving its power from the 32 foot fall noted and if it falls too near freezing, the water is heated by hot water pipes. To facilitate repair work in the generator room there is a 150-ton Alliance crane overhead.

This completed our tour of this $27,000,000 dam that serves Galesburg, Burlington, St. Louis, and Chicago. This dam, the largest on the Father of Waters, was completed in 1913 under the direction of designing engineer Hugh Lincoln Cooper and remains as an inspiring tribute to his genius.

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Introducing . . .

Mr. Harvey Mullen

Many engineering students here at Galesburg will remember the various objects used to illustrate the principles of descriptive geometry. It is most likely that this experimental equipment was made by the popular instructor, Mr. Harvey Mullen. Mr. Mullen's interest in his work is the outgrowth of his early labors in woodwork. His work, plus his interest in athletics, was the main reason

(Continued on page 27)

—Photo by Charles J. Kukura

Railroad tracks and power lines along the top of Keokuk dam, Keokuk, Iowa.

- Photo by Charles J. Kukura

Keokuk dam, stratching for almost a mile across the Mississippi.

—Photo by Charles J. Kukura

The fifteen generators of Keokuk's power plant, delivering 135,000 KVA.

EMPLOYMENT DIRECTORY

For the convenience of our readers we have contacted the companies listed below asking them about their needs for engineers. If you desire employment with any of the companies inquiries should be made directly to the company.

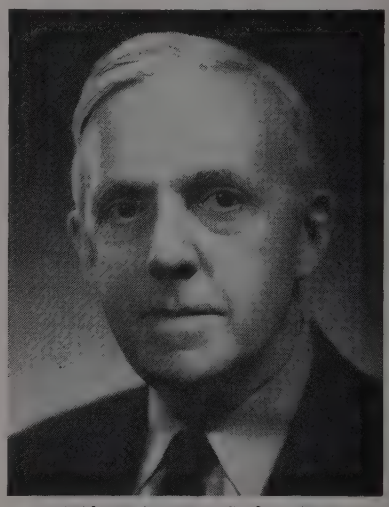
COMPANY and ADDRESS	CERAMIC	CHEMICAL	CIVIL	ELECTRICAL	MECHANICAL	INDUSTRIAL	METALLURGICAL	SPECIAL QUALIFICATIONS AND COMMENTS
Personnel Manager American Gas Association Testing Laboratories 1032 E. 62nd St. Cleveland 3, Ohio		x			x		x	Good personality, ability to cooperate with others and desire to merit promotion to higher responsibilities. Information about training program at Technograph Office, 213 E.H.
Dow Chemical Company Technical Employment Department Midland, Michigan		x		x	x			B. S. and graduate students in chemistry
Business and Technical Personnel Dept. Eastman Kodak Company 343 State Street Rochester 4, N. Y.		x		x	x	x		Specific information and application blanks may be obtained in the Technograph Office, 213 E.H.
Frick Company Waynesboro, Penn.		x	x	x	x			Want men for sales engineering: good height, appearance, and at ease with people to sell refrigerating, ice making and air conditioning equipment. M.E.'s and E.E.'s offered a two year training course in refrigeration
F. J. Littell Mach. Co. 4127 N. Ravenswood Chicago 13, Illinois Attn: Mr. F. M. Littell					x			
C. E. Butler, Off. Mgr. Norton Company New Bond Street Worcestor 6, Mass.	x	x			x			
Employment Dept. Industrial Relations Division Proctor and Gamble Co. M. A. and R. Bldg. Ivorydale 17, Ohio		x	x	x	x	x		
Training and Specialized Recruiting Div. Personnel Dept. R.C.A. Victor Div. Camden, N. J.		x		x	x			Desire top notch men with high academic standing and ability to get along with men. The R.C.A. training program is a one year period of rotated and on the job assignments within various product and staff activities.
Union Carbide and Carbon Corp. Attn: Mr. C.M. Barlow 30 E. 42nd St. New York 17, N. Y.		x		x	x			Also chemist and business administration students. Some vacancies in research, development, production, sales, advertising, industrial relations, patient and purchasing work.
George D. Lobingier Mgr. Student Recruitment Educational Dept. Westinghouse Electric Corp. E. Pittsburgh, Penn.				x	x			
F. H. Roby, General Sales Manager Square D Company 6060 Rivard Street Detroit 11, Mich.				x	x			Students in upper third of their class; initiative; leadership for sales engineering. Also frequent vacancies in Engineering and Manufacturing Dept.

President of S.A.E. Addresses Local Chapter

By C. M. McClymonds, M.E. '49

How modern automobile engines are developed by manufacturers was interestingly presented by Mr. Stanwood W. Sparrow, president of the Society of Automotive Engineers. He was a guest of the University of Illinois student branch of the S.A.E. at a meeting of the local group March 23, in 319 Engineering hall.

The organization on this campus of the student chapter of the S.A.E. on May 20, 1948, marked the start of a rapidly growing interest in a "highly American institution," (as the magazine, *Fortune,* so aptly credited it). The 51 charter members here, as well as those



STANWOOD W. SPARROW

who have since joined, have finished the steps necessary for admittance to the national membership now exceeding 15,000. The student branch has shown a mile-stone of progress which was highlighted March 23 by the presentation of the charter and the presence of Mr. Sparrow.

Mr. Sparrow's address,"Your Friend, the Engine," told of the development of the Studebaker "champion" engine from its inception to its present stage of development. The popular 80-horsepower "three-by-four" in use in America's first post-war car came as a result of years of design, development, and experimental work.

The speaker's biography is even more colorful. He looks like a scientist, acts like an engineer, and is generally regarded as one of the industry's best intellects. Some of his earlier experience in the automotive industry was obtained while

(Continued on page 36)

BURIED ALIVE

Aerial cable gets protective wrapping before going underground.

A highway near Ann Arbor, Michigan, was being widened. This meant that a telephone pole line had to come down. But the cables it carried were too busy and too important to be cut. They had to remain in constant use.

Telephone engineers got busy.

Within two months, cables along the five mile stretch were "buried alive"—with every circuit in service all the time. Every inch of cable was given a protective wrapping to make it suitable for underground use. Streets, highways and railroad tracks were crossed. Work was done at night to avoid busy-hour traffic. Yet not a single telephone call was interrupted.

The skill and initiative of the telephone engineer are important reasons why America has the finest telephone service in the world—at the lowest possible cost.

BELL TELEPHONE SYSTEM

EDWIN A. WITORT
Editor

•

PHILLIP B. DOLL
Assoc. Editor

the Illinois Technograph

Of Books and Men . . .

"Engineers are unsociable isolationists" seems to be a prevalent south-campus opinion. Is this opinion partly justified, or can it be shrugged off with a "not by choice"?

I have come to the opinion that the matter cannot be treated lightly. In trying to sell tickets to the St. Pat's Ball, I was turned away by a number of engineers who said they simply didn't know anyone to take. Many of them would have had no trouble getting and enjoying dates, if they had only known a few of the cute coeds on campus. According to ticket sales, this asocial situation was, and still is, too universal on the engineering campus. But something *can* be done about it!

Social dexterity is not only desirable but necessary from at least two important standpoints.

Because we live in a world of people, we must know how to get along with people, and how to make them our friends. We have to take an interest and learn to cooperate with our neighbors. An interesting fact worth mentioning is that second only to your hometown, your campus is the best place to start a happy marriage. Chances for success in this all-important endeavor are greatly diminished if you wait till you go to work before looking for your life partner.

Industrial concerns are consistently asking for men who know to handle themselves with ease in social situations. Notice the right-hand column of the employment directory on page 16. The demand is for engineers who have developed their leadership abilities and know how to handle personnel—men who can get out and do things. In responsible positions, you'll have to judge the personality, characteristics, and qualifications of your fellow workers. You can't judge a person's character without knowing what to look for, without the experience of meeting and working with people in all types of situations.

The usual comment is that engineers just don't have enough time to work problems, write reports, pass exams, and still partake of social functions. There may be many in this dull routine—too many—but I'm not advocating that less time be spent studying. Rather, I suggest that relaxation be done as effectively and as efficiently as possible. Movies and beer parties may be relaxing(or stiffening) but how much do they add to your life? Or do they subtract? To get the most worth-while improvement out of relaxation time, take advantage of opportunities to meet people—get acquainted with varied personalities, ideas, and interests.

From my own experience, I've found that the campus Foundations are the best and most natural places to meet and enjoy other students. In their parties and socials you'll find an informality and spirit of fellowship that will help you to learn to make friends and feel at ease socially.

If you try to be a friend to all people, you will find an experience that can't be found in books or problems, or anything but life itself.

"From quiet homes and first beginnings,
Out to the undiscovered ends,
There's nothing worth the wear of winning
But the laughter and the love of friends."

—R. L. H.

"—They perfect nature and are perfected by experience" —FRANCIS BACON

What these man-made gems mean to you

SYNTHETIC STAR SAPPHIRES like this one, which only the finest of nature's stones can equal, are now made by *man.*

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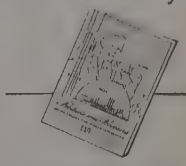

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NAVY PIER . . .

(Continued from page 14)

The organization has plans for a lecture and demonstration by a representative of the Magnaflux Corp., and a movie by the Elco Boat Manufacturing Co.

A.S.C.E.

This organization held its first business meeting of the spring semester on February 22nd. The topic was, "Summer Survey Camp for 1949." More information will appear in the next issue concerning this topic.

I.A.S.

This organization held its first business meeting of the spring semester on February 22nd. A movie on "Aircraft Wing Structure," and a movie on "Aircraft Fuselage Structure" were shown. There was also an election of officers held—results in next issue.

A.I.E.E.

In January the society was addressed by Mr. Hulla, an electronics engineer from the Westinghouse Corp., on the "Application of Electronics in Industry." Included in his lecture were such items as "voltage regulation in a generating station," "color control in painting," and "switchgear for high amperage spot welding."

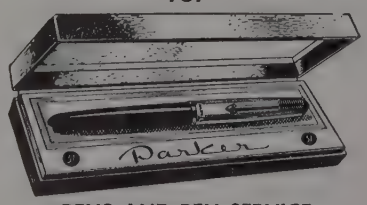
Cards were distributed to all the members present at this meeting to secure names for a nominating committee.

At the first meeting in the spring semester a film on "Adventures in Research" was shown, and an election of officers for chairman, secretary, and treasurer was held—results in the next issue.

We can get the new world we want, if we want it enough to abandon our prejudices, every day, everywhere. We can build this world if we practice now what we said we were fighting for. —Gwen Bristow.

STRAUCH'S at CAMPUS

for



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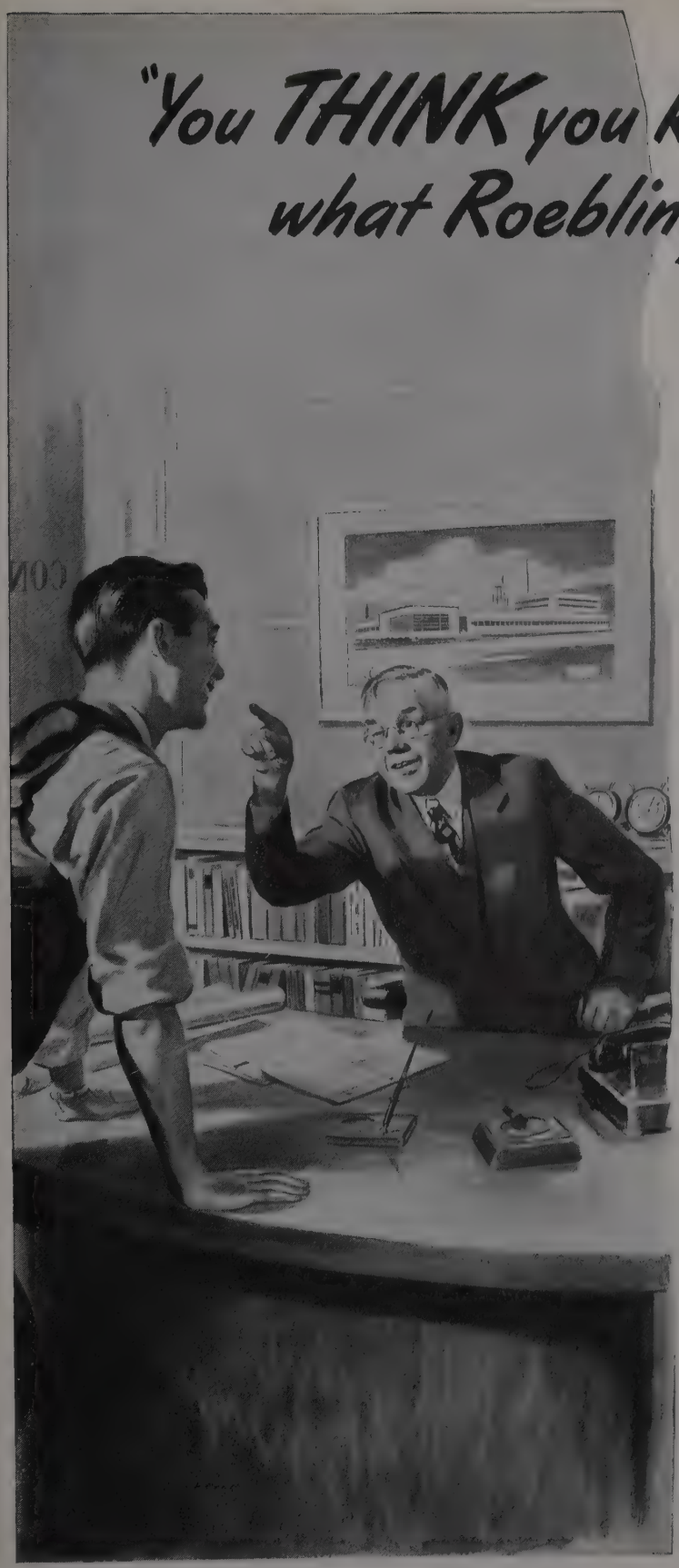

you stand there talking about Roebling wire cloth and screening. Well I tell you Roebling makes *electrical wire and cable*. I've bought them since before you were born!"

• • • •

Of course both engineers are right. At its four big plants in and near Trenton, New Jersey, Roebling makes an extremely wide variety of wire and wire products . . . develops new types and achieves quality standards of highest efficiency and service economy to industry.

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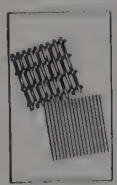

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ENGINEERING EXAM . . .

(Continued from page 11)

year for 30 years. What should the syndicate pay for the well if, out of this net income, a return of 10 per cent on the investment is desired, and a sinking fund will be established at 3 per cent interest to recover the investment?

2. A 4 per cent bond with interest paid annually will mature in 10 years. What is the market value if 3 per cent is considered a fair return?

3. Determine how much more could be paid for a hydroelectric power plant and transmission line than for a steam plant, to be run at full load for 3000 hours per year, if the operating costs for the latter as 0.6 cent per horsepower hour, while for the hydroelectric system they are only 0.2 cent. Assume the life in either case to be 30 years and interest to be 5 per cent, while all other things are equal.

4. What provisions can be made in a contract for engineering construction to avoid dispute over payments for extra work?

Group C

1. Where the presence of nitrogen is not objectionable, hydrogen for reductions may be procured by cracking ammonia at high temperature. A cylinder of hydrogen under high pressure contains 1 lb. of hydrogen and weighs approximately 100 lbs. An ammonia cylinder containing 100 lbs. of ammonia weighs approximately 150 lbs. A plant wishes to reduce one ton of Fe_2O_3 to metallic iron per day with hydrogen. If freight is 20 cents per 100 lbs. and it costs three cents per pound to crack ammonia, calculate and compare the costs of cylinder hydrogen and hydrogen from ammonia. Ammonia costs 12 cents per pound and cylinder hydrogen $1.00 per pound.

2. It is desired to market oxygen in small cylinders having volumes of 0.8 cu. ft. each containing 1.5 lbs. of oxygen. If the cylinders are subjected to a maximum temperature of 110° F., calculate the pressure for which they must be designed. Assume the applicability of the simple gas law.

3. How much heat is lost per hour from a rotary kiln, 30 ft. in length by 3 ft. inside diameter (I.D.)? The kiln is covered with insulating brick (k equals 0.05 Btu/°F. ft. hr.) of 2.0 ft. thickness, and the temperature of the outside surface of the brick is 500°F. less than the inside surface of the brick.

Group D

1. A 36-inch, new vitrified sewer pipe on a one-half per cent slope is flowing 24 inches deep. How many cubic feet of water are flowing per second?

2. Calculate the elevations at 50 ft. stations for a circular vertical curve 600 ft. long between tangent grades at 3.96 per cent (before) and 4.32 per cent (after) meeting at Station 13/25 at elevation of 105.68 ft.

Group E

1. A balanced three-phase load, star-connected, has a resistance of six ohms, and an inductance of 0.015 henries in series in each phase. The load is supplied at 120 volts, sixty cycles.

(a) What is the line current?

(b) What is the power consumed per phase and the total three-phase power consumed?

(c) Draw the complete vector diagram of currents and voltages.

(d) Show a connection diagram for connecting two watt-meters to read the total three-phase power. What will be the reading of each meter?

(e) What is the reactive power of the circuit?

2. (a) In a shunt-wound motor the applied voltage is 240 volts, and the back emf is 230 volts. The resistance of the armature is 0.25 ohms and that of

(Continued on page 24)

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Pocket Gamma Ray Dosimeter

A personnel protection instrument to measure cumulative exposure to x- or gamma rays. The cylindrical case contains an ionization chamber and a quartz fiber electrometer. Optical system enables position of the fiber to be read easily upon a 40-division translucent scale. Standard range O-200 milliroentgens. Size 4¾" x ½" dia.

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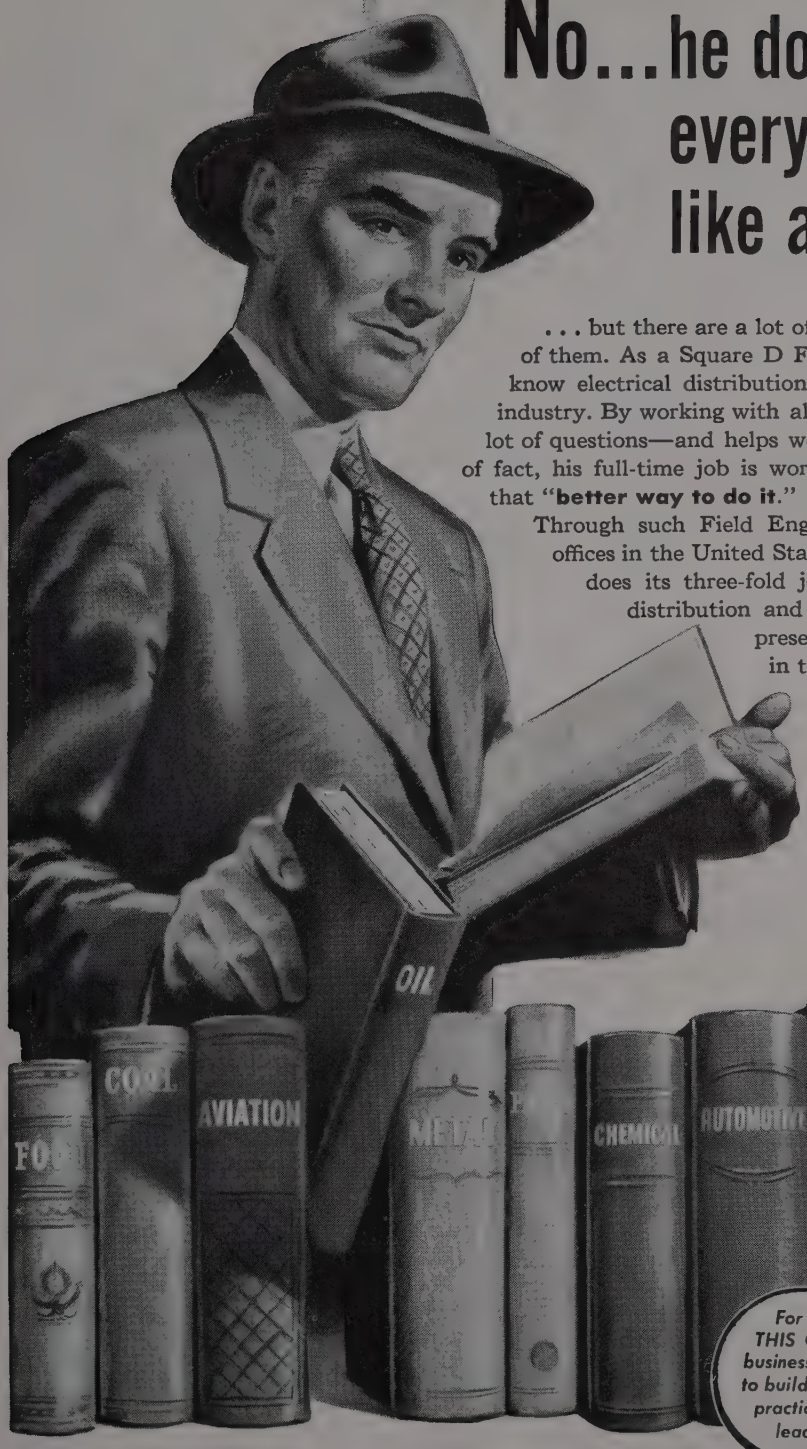

...but there are a lot of things he does know about each of them. As a Square D Field Engineer, it's his business to know electrical distribution and control as it applies to any industry. By working with all kinds and sizes, he encounters a lot of questions—and helps work out the answers. As a matter of fact, his full-time job is working with industry—helping find that "**better way to do it.**"

Through such Field Engineers, located in more than 50 offices in the United States, Canada and Mexico, Square D does its three-fold job: Designs and builds electrical distribution and control equipment in pace with present needs—provides sound counsel in the selection of the right equipment for any given application—anticipates trends and new methods and speeds their development.

If you have a problem in electrical distribution or control, call in the nearby Field Engineer. He'll help a lot in finding a "**better way to do it.**"

For many years, ADVERTISEMENTS SUCH AS THIS ONE have appeared regularly in leading business magazines. Their primary purpose is to build acceptance for Square D Field Engineers, practically all of whom come to us from leading engineering schools such as yours.

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ENGINEERING EXAM . . .

(Continued from page 22)

the field, 60 ohms. If the iron and copper losses in the armature are equal, what is the efficiency of the motor?

(b) A d-c motor under test gave the following results:
Voltage 460 volts
Current 30 amps.
Effective load on brake at periphery 200 lbs.
Diameter of brake pulley 6.25 in.
R. P. M. 1725

Find the brake horsepower and the efficiency.

Group F

1. A furnace wall consists of nine inches of firebrick, 4½ inches of Sil-O-Cel brick, and 4½ inches of building bricks. Calculate the heat transmission through the wall in Btu per hour per square foot when the inside surface is 2400°F., and the outside room and air temperature is 100°F. Use K for firebrick as 0.81, K for Sil-O-Cel as 0.043, and K for building brick as 0.40. State clearly any assumptions made.

2. A manufacturing plant has installed reciprocating steam-driven air compressors and finds it more economical to modernize with electrical-driven equipment. Daily average demand is 1250 cfm, with maximum and minimum demand factor of 1.5 and 0.6, respectively. Past records indicate a rate of growth of 7 per cent per year. You are asked to select equipment for a 10-year growth. Outline size, type, drive, and number of compressors you would select, and give reasons.

3. A gear reduction set on a lathe with ratios 1:4, 1:6, and 1:8 has final drive gear on a lead screw shaft. If the shaft has eight threads per inch, what must be the RPM of the original line shaft to produce final translation of apron of two inches per minute.

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Working to give you *bigger,* brighter pictures, RCA engineers and scientists developed a new way to make large, direct-view television tubes. They found a method of "welding" large areas of glass and metal . . . while keeping a vacuum-tight seal!

Using this development—ideally suited to mass production—RCA can now build television tubes of light, tough metal . . . using polished glass for the face, or "screen."

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Development of this new way of making television tubes is a continuation of *basic television research* which began at RCA Laboratories. Such leadership in science and engineering adds *value beyond price* to any product or service of RCA and RCA Victor.

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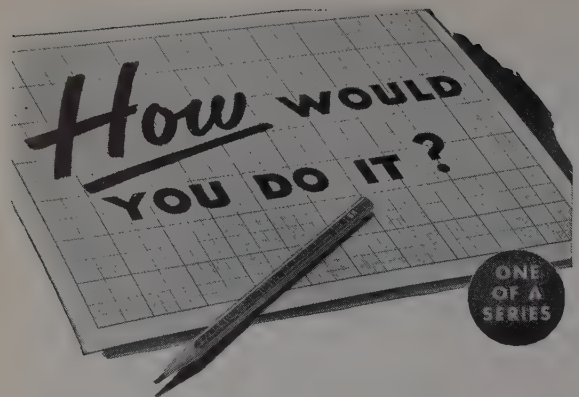

PROBLEM — You are designing a diathermy unit. Included in the electrical circuit are variable elements which must be adjusted during operation. The control knobs must be located where they will be convenient to the operator. The variable elements themselves must be located in the cabinet where they will be easy to mount, to wire and to service. How would you do it?

THE SIMPLE ANSWER — Use an S.S.White remote control type flexible shaft to couple each variable element to its control knob. This simple arrangement makes it possible to place the elements and their controls anywhere you want them. And you will find, too, that operation with these shafts is as smooth and sensitive as a direct connection, because S.S.White remote control flexible shafts are designed and built especially for this type of duty.

* * *

This is just one of hundreds of remote control and power drive problems to which S.S.White flexible shafts provide a simple answer. That's why every engineer should be familiar with the range and scope of these "Metal Muscles"* for mechanical bodies.

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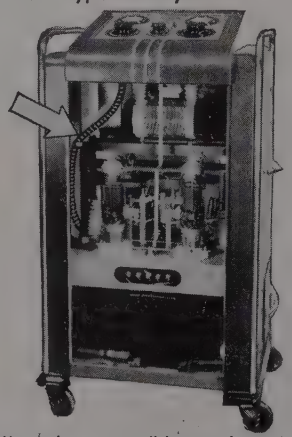

Here's how one well known electronic equipment manufacturer did it. The flexible shaft (arrow) connects control knob at top to a variable element at the bottom rear.

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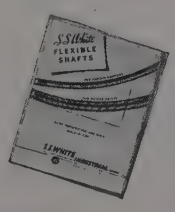
It gives essential facts and engineering data about flexible shafts and their application. A copy is yours free for asking. Write today.



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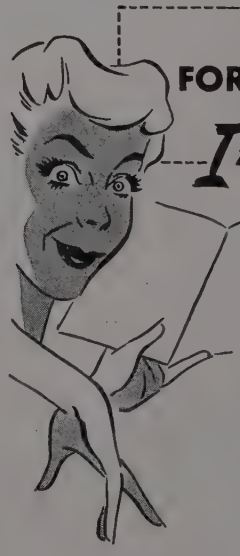

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GALESBURG . . .

(Continued from page 15)

for his entering the Kansas State Teachers college and studying in the architectural curriculum. His ability to maintain friendly relations with people was demonstrated in college life, for he had a keen interest in extra-curricular activities and also served three years on the football team.

Like all discerning students Mr. Mullen decided early that the college's main effort is to give an education. Because of this realization, he did graduate work at the Colorado College of Education after receiving his B.S. degree from Kansas State.

His first position was with the high schools of Colorado, but industry next laid claim to Mr. Mullen's talents. At the beginning of World War II he decided that industry was not his line, and he re-entered the teaching profession at the Jefferson City Junior college, an extension of the University of Missouri.

During the war, Mr. Mullen was an instructor in the E.S.M.W.T. (Engineering Science Management War Training) program at the same college. Finally the wander lust prevailed in him once again and he struck out for greener pastures, arriving at Galesburg in February of 1947.

HARVEY MULLEN

It wasn't long before the students learned that Mr. Mullen was their friend, able and willing to help anyone and everyone who sought his advice. His interests are varied and he enjoys talking with students about almost anything. Due to his Army experiences in World War I, he can hold his own in any of those "old soldier" bull sessions.

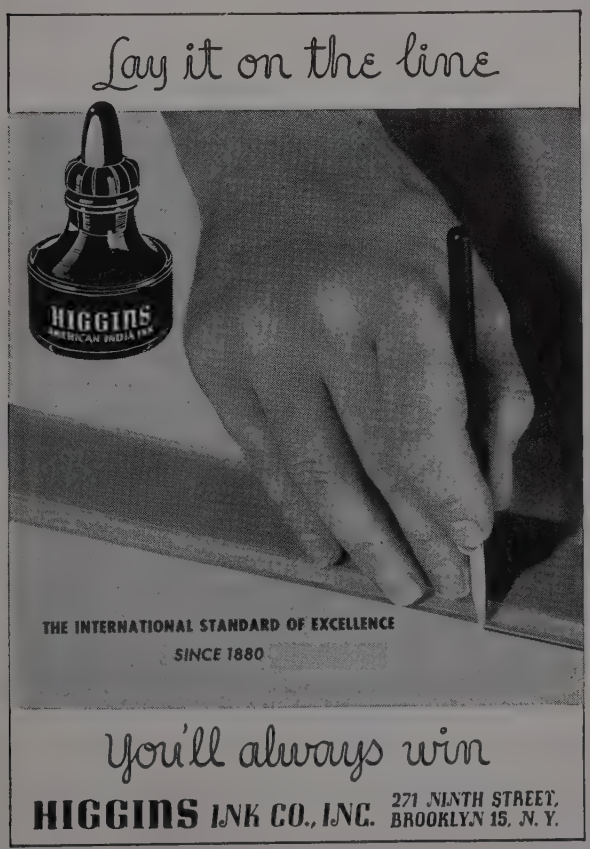
His duties here at school are many, but he has found time for a very interesting hobby, the making of furniture. He is also a Mason and a member of the American Association of University Professors. All these activities combined with his past experiences indicate that Mr. Mullen is an active person, an able instructor, and a man who takes much pleasure in aiding his students.

FRESHMAN ORIENTATION

Our aim in presenting these accounts is two-fold: Although this program is required only of new students, we feel the information is of equal importance to all the old, experienced engineering students and at the same time will give the new students something a little more permanent than a lecture.

The program committee, under the chairmanship of Professor F. W. Trezise, has obtained some well-known and distinguished men to speak. Included among these personalities are such well-known men as Mr. L. J. Fletcher, who is director of training and community relations for the Caterpillar factory in

(Continued on page 28)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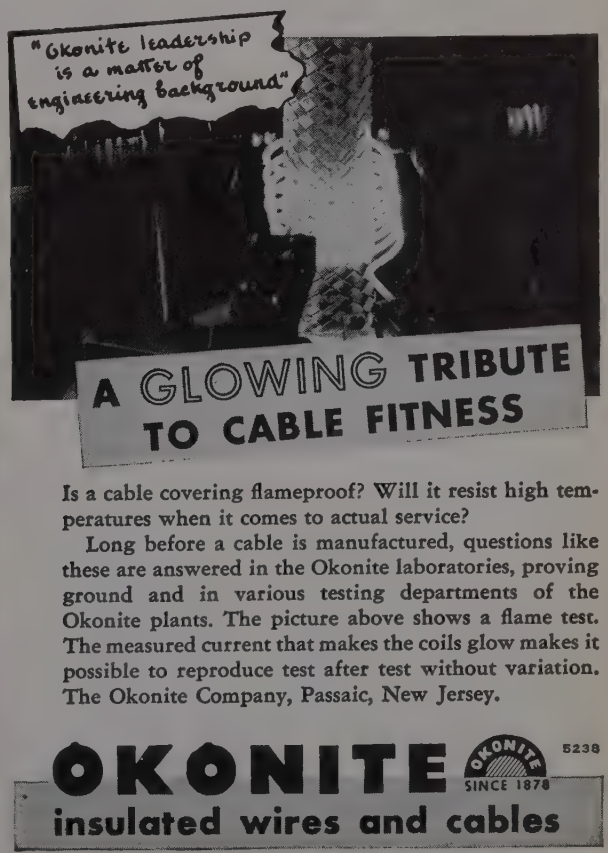
"Okonite leadership is a matter of engineering background"
A GLOWING TRIBUTE TO CABLE FITNESS
Is a cable covering flameproof? Will it resist high temperatures when it comes to actual service?
Long before a cable is manufactured, questions like these are answered in the Okonite laboratories, proving ground and in various testing departments of the Okonite plants. The picture above shows a flame test. The measured current that makes the coils glow makes it possible to reproduce test after test without variation. The Okonite Company, Passaic, New Jersey.
OKONITE
SINCE 1878
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insulated wires and cables

GALESBURG . . .

(Continued from page 27)

Peoria, Illinois, and Mr. J. F. Roberts, who is manager of the Hydraulic Dept. of Allis-Chalmers Mfg. company.

Mr. L. J. Fletcher, who is also past president of the American Society of Agricultural Engineers, and is on the board of trustees of Bradley University in Peoria, Illinois, gave the pre-engineering students valuable tips on how they may prepare themselves for their work in industry. His general topic was "The College in Industry." This included a rather unique definition upon which the college graduate's success depends. His definition stated that "the success of the college graduate in industry depends upon the amount of industry in the college graduate."

Mr. Fletcher stated that industry itself is merely people and the know-how which they possess. Therefore, the graduate engineer is concerned, to a large extent, with the actions and peculiarities of people. The personality of the engineer is extremely important when brought into this light. When, upon graduation, he is interviewed by the representative of one firm or another he is placed within a showcase, wherein he must prove to the representative that his ability to cope with people and their personalities is of sufficient quality to be acceptable. Then, and only then, is he offered a position with the firm represented.

Obviously, the scholastic average of the student is also of importance, but it is the opinion of the Mr. Fletcher that the success of the engineer is dependent upon from fair to good grades and upon a pleasing personality.

Mr. Roberts was concerned mainly with acquainting the orientation group with the processes and problems involved in the construction of a dam. He also explained quite thoroughly the position of the civil engineer in hydro-electric work.

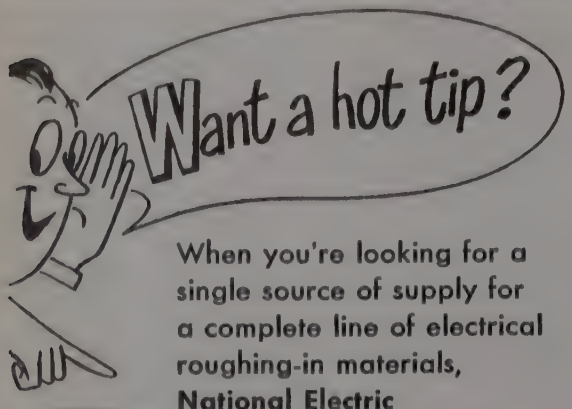
The process of constructing a large dam is quite complicated and thus could only be outlined by Mr. Roberts. However, he supplemented his fine talk with numerous slides showing the various important features of a well-constructed dam.

A site sufficiently capable of producing the necessary power and also capable of bearing such a large structure is of prime importance. Once a proper site has been selected, the civil engineer has the all-important task of surveying the land and the subterranean strata to determine whether or not there would be any water power loss due to underground leakage. He must also estimate, with a large degree of accuracy, the cost of the land, the construction of bridges and railroads, the cost of moving both industries and people out of the land to be flooded, and the cost of constructing the dam itself. These are only a few of the considerations that must be taken into account before a total estimate of both time and cost can be made. Careful design and planning can save both money and time, and is therefore of great importance.

Following this estimation and planning a schedule is made up to coordinate the actual construction. Such a schedule is generally made flexible so that any necessary deviations from it can easily be made.

The problems encountered are varied and many but probably the most impressive of those explained by Mr. Roberts was the fact that allowances had to be made for the growth of the structure itself. This growth, as much as one-tenth of an inch per year per foot of depth of concrete, had led to the comparatively new study of the chemistry of dam construction. This "growing" of dams has caused some damage to the turbines contained therein. The growth is apparently due to the swelling of the alkaline particles in the aggregate. However, allowances are now made for the turbines within the structure so that no damage

(Continued on page 30)



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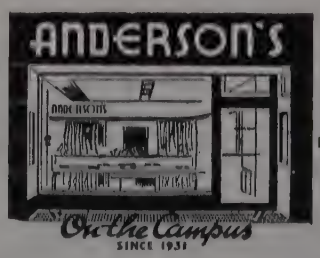

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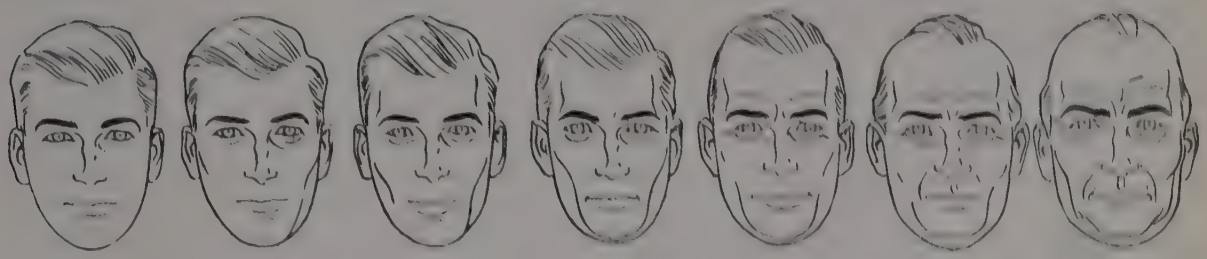
When Does An Engineer Finish Exams?



The answer, of course, is never—*not as long as he continues to be an engineer.* As an engineer, every problem put to you, in school and out, will always test your professional skill and ingenuity. The next step, then, is to *make sure you'll always pass.*

Today you're passing those exams with the information you're getting out of books, lectures and the laboratory. Tomorrow, when you are out on the job, the lectures and the laboratory will be gone. But your engineering books will always be there, and to them you will add the business and technical magazines devoted to your special branch of work.

Many of the books you are using now and will use throughout your career bear the McGraw-Hill imprint, for McGraw-Hill is the world's leading publisher of technical and scientific works. Pick up the writings of an authority in your branch of engineering and there's a good chance they were published by McGraw-Hill, for McGraw-Hill books are the works of the leaders in technology and science.

In the McGraw-Hill magazine covering the industry you're preparing for, you will find the news and reports on current developments in your profession that every engineer and businessman needs to keep posted. Editors of McGraw-Hill magazines, for example, travel over 2 million miles a year to probe for the facts and news they bring their readers.

For the exams you'll always have to pass—keep yourself posted with McGraw-Hill books and magazines.

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HEADQUARTERS FOR TECHNICAL INFORMATION

330 West 42nd Street, New York 18, N. Y.

GALESBURG . . .

(Continued from page 28)

is expected in any of the newer types of dams.

The conbination of such speeches as those given by Messrs. Fletcher and Roberts aid the student of engineering immeasurably. They not only add to the students' knowledge of the field of engineering but also give them a wide range of general information. It has been the practice of the speakers thus far to open the lecture to informal discussion at the conclusion of the hour and it is then that the student obtains answers to problems which may have troubled him previously. It is through the medium of such discussion and lecture groups that the future leaders of our nation's industry are formed, and it is the sincere hope of all those concerned that this program will be continued in the future.

THAT DECIMAL POINT

Attention, engineers who are careless with the math. Below is an excerpt from a letter received by Professor Trezise from an engineer friend:

Puebla Tramway, Light and Power Co.
January 26, 1949

Dear Fred:

I was indeed gratified upon receiving your card, and its written message. You are indeed fortunate, think I, in being in education. I have often imagined what great stimulus it must be to live among people who can afford the time to do abstract thinking, instead of the more focused thinking connected with a job—and to have the privilege of guiding younger thoughts through channels that will lead them to even more profound knowledge than has their teacher.

Since you heard from me (a couple of letters must have gung aglee), I finished the Merida job, and built a steam plant here. Then went to Celoya to iron out the wrinkles in a new plant there prior to putting it on the line. At present, the company has placed me in charge of all of the generation and transmission in the southern Mexican district with headquarters here at Puebla.

We have nine small (800 to 56,000 kw.) hydro-electric plants, and one steam plant, the new one at Puebla. In addition we purchase power from the government steam plant at Veracruz, and from several industrial plants on a power exchange basis.

The construction of the Puebla steam plant offered some unusual problems in foundation work. Several years before I came here a stenographer made an error in placing a decimal point, and the dictator failed to catch it. Soil bearing tests indicated a maximum safe loading of .42 kilograms per square centimeter. The steno wrote 4.2, and New York used that figure in their design of footings. Result was that when the plant was half built (all of the building and footings were in place) we noted foundation failure. Footings were redesigned and rebuilt—and the pedestal for the unit was torn down and rebuilt on piles.

A 48′ x 48′ high steel storage tank was lifted four feet, out of the mud into which it had sunk, moved 80 feet and then moved back on an extended crushed rock foundation carried down to underlying limestone layers. . . .

Sincerely,
Arthur Wheatley

Along the same line, the following paragraph was written on a C. E. final last semester:

"In second order surveying work, there should be no mistakes because mistakes and discrepancies can be totally eliminated by checking and cagey technics. . . ."

Great men speak to us only so far as we have ears and souls to hear them; only so far as we have in us the roots, at least, of that which flowers out in them.—Durant.

Unloading one of the 15 Frick Blizzard Freezers at Mt. Vernon, Wash. Temperature is 40° below 0. Installed by Lewis Refrigeration & Supply Co., Seattle.

Quick-freezing 80,000 Pounds of Poultry with FRICK Refrigeration

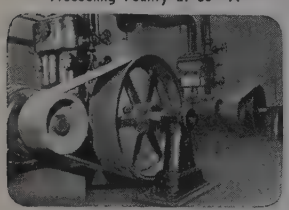
Precooling Poultry at 33° F.

That's just one day's work at the new plant of the Washington Co-Operative Farmers Assn. But it means 16,000 chickens or 4,000 turkeys have to be processed, precooled, quick-frozen, and stored at zero.

Frick Refrigeration carries the entire cooling load at this Mt. Vernon, Washington plant—just as it does in the world's largest quick-freezer, across the continent at Bridgeton, N. J.

If you're anywhere in between, and need refrigeration, get in touch with the nearest Frick Branch Office.

The Frick Graduate Training Course in Refrigeration and Air Conditioning, operated over 30 years, Offers a Career in a Growing Industry.



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Gaging work using External Comparator No. 951 and Amplifier No. 950.

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Adaptable to many special applications such as sorting and quality control devices. Simple setting provides readings of .0001" to .00001". Intermediate settings can be made easily to match prescribed tolerance limits. Equipment includes: amplifier unit; external and internal comparators; gage head cartridge for jig or fixture mounting; signal light attachment. Write for catalog. Brown & Sharpe Mfg. Co.,

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Scene from the Alcoa Technicolor Film, "Unfinished Rainbows", starring Alan Ladd as Charles Martin Hall with Janet Shaw as his sister Julia. Available on request for your church, school or organization. Address Gulf Building, Pittsburgh 19, Penna.

ALAN LADD now co-starring in "WHISPERING SMITH", a Paramount Picture. Color by Technicolor.

How a group of American pioneers has held the price of Aluminum down

Charles Martin Hall, founder of America's aluminum industry, had a special kind of gleam in his eye. Every one of us has it too.

He was bound and determined to find a way to make aluminum cheaply. The schoolbooks all tell how he did it, where the world's greatest scientists failed.

Bluntly speaking, Charles Martin Hall set out to cut the world price of aluminum.

He was the first of the men and women of Aluminum Company of America. He licked a process. We who followed him—engineers, chemists, metallurgists, physicists, production experts—have been at it ever since.

But the gleam is the same. It's bumping elbows in the research lab with men who, in fifty years, have accomplished most of the finding-out that took fifty centuries, with the age-old metals.

It's working in the mill and having it seem that every shining sheet racing over the rolls is your own.

It's typing a letter in answer to a simple query, and having the deep-down feeling that you may be in at the birth of a new business, taking root in aluminum.

We propose to keep on being pioneers in broadening the usefulness of aluminum. Alcoa Aluminum sold in 1939 for 20 cents a pound. It sells today for 16 cents.

We are pioneering with microscopes and calipers and rolling mills. We'll stack them against axes and squirrel rifles and spinning wheels, for a place of importance in the history of our America.

To know other stories of the Alcoa family and the growth of aluminum's usefulness to you, write for free copy of "Aluminum—Its Story", ALUMINUM COMPANY OF AMERICA, *Gulf Bldg., Pittsburgh 19, Pa.*

ALCOA FIRST IN ALUMINUM

"Mamma, do angels have wings?"
"Yes, dear," replied the mother.
"And can angels fly, mamma?"
"Yes, dear."
"Daddy said nurse was an angel last night. When will she fly?"
"Tomorrow," replied the mother.

* * *

Prospective Employer: "Are you looking for work, my good man?"
M. E.: "Not necessarily—but I'd like a job."

* * *

A coach is a fellow who is always willing to lay down your life for his school.

"Why are you crying, little girl?"
"Cause my brother has holidays and I don't."
"Well, why don't you have holidays?"
"'Cause I don't go to school yet."

* * *

The E. E. student was puzzled. "Hey," he called to his lab partner, "put on one of these wires."
His lab partner did as he was told.
"Feel anything?"
"No."
"Good," replied the E. E. "I wasn't sure which was which. Don't touch the other or you'll drop dead."

He dashed up to the bar and hollered: "Gimme a double shot, quick, before the trouble starts!"
The bartender did, and he drank it.
"Gimme another double shot—before the trouble starts."
The bartender, puzzled, did, and asked: "Before what trouble starts?"
He replied sadly: "It's started now. I ain't got any money."

* * *

"You say you never have a quarrel with your wife?"
"Never. She goes her way and I go hers."

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The Complete Clothing Store for Men and Young Men
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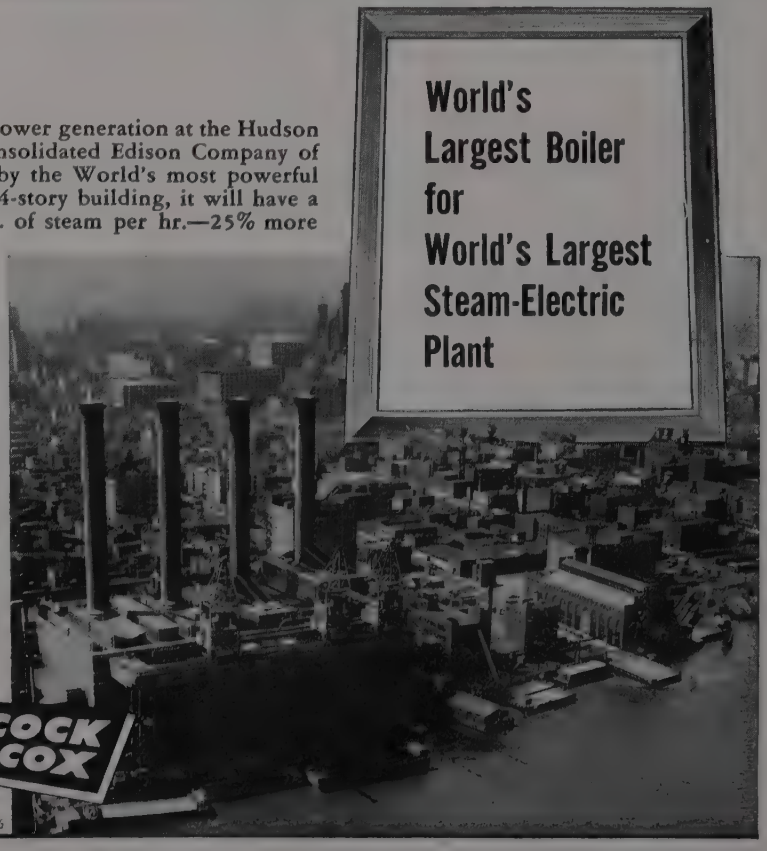
Additional steam for power generation at the Hudson Avenue Station of Consolidated Edison Company of New York, Inc., will be supplied by the World's most powerful boiler—now on order. High as a 14-story building, it will have a continuous output of 1,300,000 lbs. of steam per hr.—25% more than its nearest rival also on order for the same utility. The volume of water converted hourly into steam by this unit would fill over 2½ million tall tumblers—enough to serve 8 glassfuls a day to every resident in Greater New York City; its hourly coal consumption would heat an average home for over 6 years!

Making boilers that make history is an 80-year-old story with B&W. So, too, are pioneer advancements in many other fields.

Through its great diversity of progressive activities B&W offers unusual career opportunities to technical graduates in research, engineering, production, sales and other vocations.



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Variety of Equipment used by

SUPERIOR METAL TREATERS, INC.

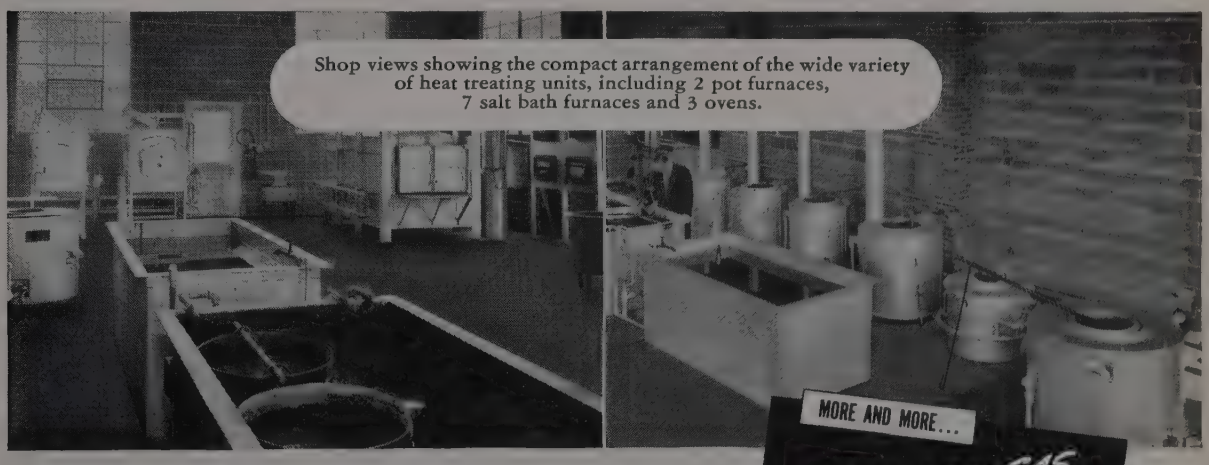
Emphasizes the Versatility of GAS

VARIETY is one of the most characteristic features of a commercial heat treating shop—variety of customer demands and variety of equipment required to fulfill them.

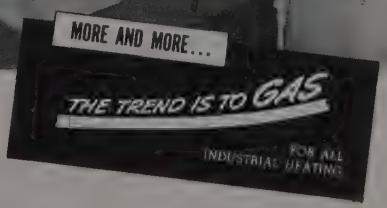
With a background of 22 years experience, Evan D. Ehmann, President of Superior Metal Treaters, Inc., knew just what to look for when he established his Newark, New Jersey, shop. This modern plant has the productive capacity to cope with the miscellaneous requirements of many customers.

Key feature of the installation is the versatility of the equipment. Each unit was chosen for its ability to perform under a number of different conditions. In selecting this equipment Mr. Ehmann determined to use GAS because, as he expresses it, "During my years in this business I discovered that Gas Equipment provided the accurate control, economical operation, and versatility we needed. The precise temperatures and speed of heating we obtain with GAS mean a lot of extra production in our shop."

Whether the heat treating process is a production-line application, or a commercial shop operation, the flexibility of GAS and the versatility of modern Gas Equipment are important economic factors. The characteristics of GAS make it stand out in any comparison with other available fuels for heat processing.



Shop views showing the compact arrangement of the wide variety of heat treating units, including 2 pot furnaces, 7 salt bath furnaces and 3 ovens.



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JUST AROUND THE CORNER ON GREEN STREET

The Gospel According to Saint Joe

Verily, I say unto you, marry not an engineer for the engineer is a strange being, possessed of many devils; yea, he speaketh eternally in parables which he calleth "formulas", and he hath but one Bible.—a handbook.

He talketh always of stresses and strains, and without end of thermodynamics. He showeth always a serious aspect and seemeth not to know how to smile; and he picketh his seat in the car by the springs therein and not by the damsel beside him; neither does he know a waterfall save for its power, nor the sunset except for her absorption spectrum.

Always he carrieth his slide rule with him and he entertaineth his maiden with steam tables. Verily, though his damsel expecteth chocolates, when he calleth he brings samples of iron.

Yea, he holdeth his damsel's hand, but only to measure the heat content thereof, and kisses but to test the viscosity. In his eyes shineth a faraway look which is neither love nor longing—but a vain attempt to recall a formula.

There is but one key to his heart, and that is the Tau Beta Pi key; and one love letter for which he yearneth and that an "A"; and when to his damsel he writeth of love and signeth with crosses, take not these symbols for kisses but rather for unknown quantities.

Even as a youth, he pulleth a girl's hair to test its elasticity, but as a man he discovered different devices: for he would count the vibrations of her heartstrings and reckons her strength of materials; for he seeketh ever to pursue scientific investigations, and inscribeth his passion in a formula; and his marriage is an equation involving two unknowns and yielding diverse answers.

Prosperity is only an instrument to be used, not a diety to be worshipped. —Coolidge.

* * *

All experience hath shown that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed.—Jefferson.

One-Question Exam On FASTENING

Q. Does it cost more to buy or use fasteners?

A. It's the cost of using a fastener that counts, not the initial purchase price. So the man with the responsibility of buying or specifying fasteners should make sure that *every* function involved in the *use* of bolts, nuts, screws, rivets and other fasteners contributes to the desired fastening result—maximum holding power at the lowest possible *total* cost for fastening.

YOU GET TRUE FASTENER ECONOMY WHEN YOU CUT COSTS THESE WAYS

1. Reduce assembly time with accurate, uniform fasteners
2. Make satisfied workers by making assembly work easier
3. Save receiving inspection through supplier's quality control
4. Design assemblies for fewer, stronger fasteners
5. Purchase maximum holding power per dollar of initial cost
6. Lower inventory by standardizing types and sizes of fasteners
7. Simplify purchasing by using one supplier's complete line
8. Improve your product with a quality fastener

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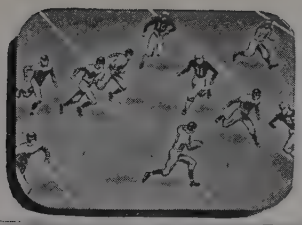

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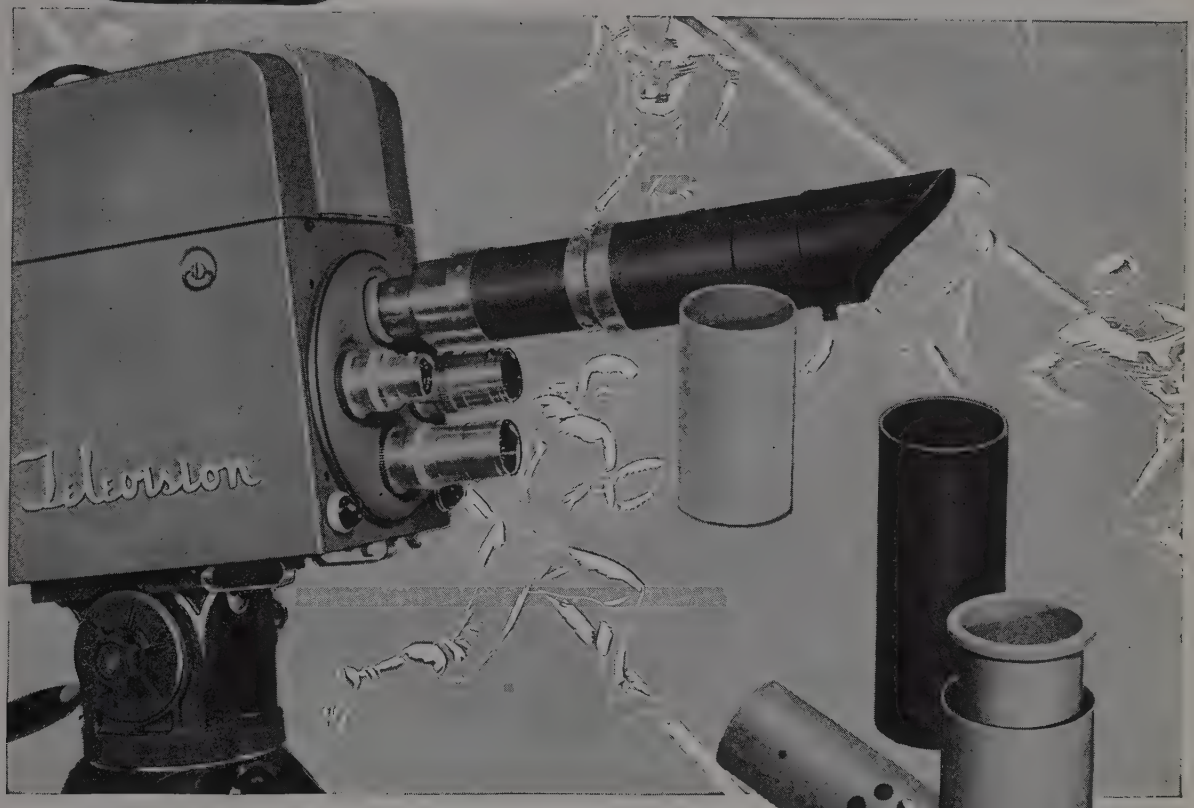
for high dielectric and structural strength, light weight and ease of machining



In the RCA television camera, for example, Synthane was selected for coil forms, tubes, flanges and other components because of its electrical insulating properties, especially at high frequencies and high voltages. Its ease of machining, light weight and structural strength were other factors that led RCA's design engineers to select Synthane as the best possible material for this job.

Synthane, laminated phenolic plastic, is at its best in applications requiring unusual *combinations* of characteristics. Its excellent electrical insulating ability, combined with ease of machining, light weight, rigidity and many other properties, such as moisture and corrosion resistance, make Synthane a valuable material for many industries.

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SYNTHANE

where Synthane belongs

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Another NORTON "FIRST"

THIS time it's a *ceramic* surface plate—an entirely new type of plate for toolmakers and inspectors to use in making their precise measurements. This Norton-developed ceramic plate has distinct advantages over previous types of surface plates including: (1) a longer-lived surface, (2) a smoother surface, (3) a flatter surface and one that *stays* flat. It will not warp nor deform, not sweat nor corrode, not deflect under load.

The development of this unique surface plate is typical of the progressive research that has made Norton an acknowledged leader—not only in abrasives and grinding wheels but also in the development of grinding and lapping machines, high temperature refractories and a wide variety of wear-resistant materials.

In the Norton laboratories at Worcester, Chippawa and Troy, there are 195 scientists, engineers and technicians constantly at work on new or improved Norton products.

NORTON COMPANY, WORCESTER 6, MASS.

Behr-Manning, Troy, N. Y., is a Norton Division

The main Worcester plant of Norton Company—world's largest producer of abrasive products

NORTON

ABRASIVES — GRINDING WHEELS — GRINDING AND LAPPING MACHINES
REFRACTORIES — POROUS MEDIUMS — NON-SLIP FLOORS — NORBIDE PRODUCTS
LABELING MACHINES (BEHR-MANNING DIVISION: COATED ABRASIVES AND SHARPENING STONES)

1001 NIGHTS . . .

(Continued from page 7)

of mud carved out of the ground and burned for three days in the sun. "Bally poles" were the trunks of abundant young poplar-like trees, ranging in diameter from six to eight inches. Mortar was a mud-straw combination, and plaster was a refined type of mud known as "sweet earth," whose consistency is selected for its taste.

While all the main construction reports containing the most pertinent data are filed away in the proper military offices, there were a few other, smaller incidents that will only live on by passage of word-of-mouth. There was the story of an airfield on the south coast of Arabia that was constructed of 430 tons of supplies hauled inland over 25 miles of country roads by a camel caravan numbering 1,100. On another job, when the native labor slacked off on their work, the American civilian superintendent bought his Arab foreman three new wives at $10 apiece from a local market —p r o g r e s s spontaneously improved. There was another rumor of a wily Arab chieftain who demanded payment for his men in Maria Therese dollars, old silver Austrian coins; by stint of an expensive plane trip to Austria once a month, the contractors paid the Arab his price.

The Persian Gulf Command had just about completed their assignment in December in 1944. They started on nothing and came out with a spectacular climax, and in the process, saw little of the Iran of a thousand and one nights. All they will remember of Iran is one little factor that makes a pleasant topic of conversation over here in America. Hereafter, when a remark about the hot weather is made in the presence of one of the Command boys, he won't say a word—he'll just grin.

S.A.E. . . .

(Continued from page 16)

testing the famous Liberty and Hispano-Suiza aircraft engines of World War I. After work connected with numerous projects at the National Bureau of Standards, Mr. Sparrow went to Studebaker in 1927 and has been at South Bend, Indiana, ever since. By the time World War II broke out, he was chief research engineer, and devoted almost his entire time to the supervision of Studebaker's building of the Wright "cyclone" engine. Now he is vice president of engineering, and ranks among the automotive industry's six senior engineers. He has been an S.A.E. councilor; a member of the S.A.E. Technical board; chairman of the Washington section; and served several years as chairman of the Publications committee.

DU PONT Digest
For Students of Science and Engineering

Chemists in Pictures

How Du Pont and studio scientists solved the problem of noisy film

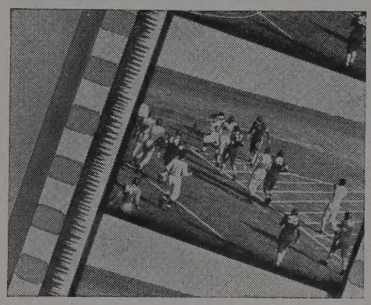
Who'd ever expect to find Du Pont chemists in Hollywood? When motion pictures suddenly started to talk, a whole new series of perplexing scientific problems was born, not the least of which was "noisy" film.

As you know, sound is usually recorded directly on film. If you hold a strip of motion picture film to the light, the sound track is seen as a narrow band of irregular lines. A light ray passing through the moving sound track falls on a photocell with rapid interruptions or changes in intensity. The photocell converts these interruptions into electrical impulses which, amplified, reach the theater audience as voice and music.

If the film has a coarse grain structure, it tends to give lines that are not sharp and uniform in density. Such irregularities interrupt the light ray—come out as distracting noise.

What could be done about it? Du Pont scientists of the Photo Products Department started a program of research, in cooperation with technical experts from the studios in Hollywood. They made and tested scores of film coatings. Finally there were developed films of exceedingly fine grain structures.

M-G-M and Paramount were among the first to use the new type Du Pont films. The development was heralded by the press as "another milestone in the technical progress of the industry," and in 1943 Du Pont

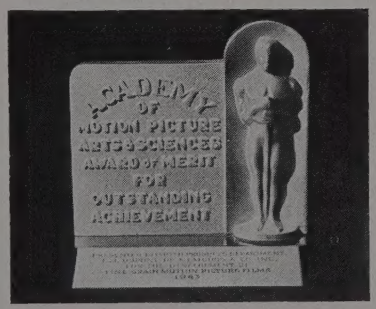


Voice and music *appear as a continuous band of irregular lines on this movie sound track. Any irregularity means noise.*

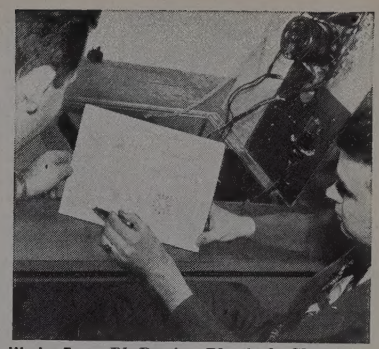
received an Academy Award of Merit for its achievement. Now the use of fine grain films is practically universal in Hollywood. Actors, actresses speak their lines, with no technical restrictions to cramp their artistry.

You may have a place in Du Pont research

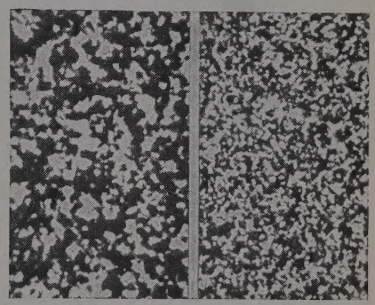
Had you been a member of a Du Pont Photo Products research team since 1931, you might have shared in many outstanding achievements, two of which have been recognized by "Oscars."



Achievements *of Du Pont scientists over the years have won two "Oscars" from Academy of Motion Picture Arts and Sciences.*



W. L. Foy, *Ph.D. in Physical Chemistry, Clark University, 1947, and A. C. Lapsley, Ph.D. in Physics, Virginia, 1947, discussing details of Color Densitometer Wiring Diagram used in connection with research on color photography.*



In coarse grain films, *the particles of silver are large and scattered. Compare with Du Pont fine grain film, right. (Magnified 1000 times.)*

The Photo Products Department, however, is just one of ten Du Pont manufacturing departments, all of which engage in continuous research. Operated much like separate companies, each holds challenging opportunities for young, college-trained chemists, engineers and physicists. Du Pont not only tries to select young men and women of promise, but makes a conscientious effort to help each one develop as rapidly as possible. Whatever your interests, you will find here the cooperation and friendly interest you need to do your best. As a member of a small, congenial working team, your ability can be seen, recognized and rewarded.

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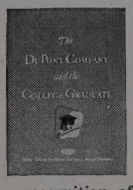

Send for your copy of "The Du Pont Company and the College Graduate." This fully illustrated, 40-page booklet answers your questions, describes many fields which may be new to you. Tells about opportunities in research, production, sales, etc. Explains how recognition of ability is assured. For free copy, address: 2518 Nemours Bldg., Wilmington 98, Delaware.

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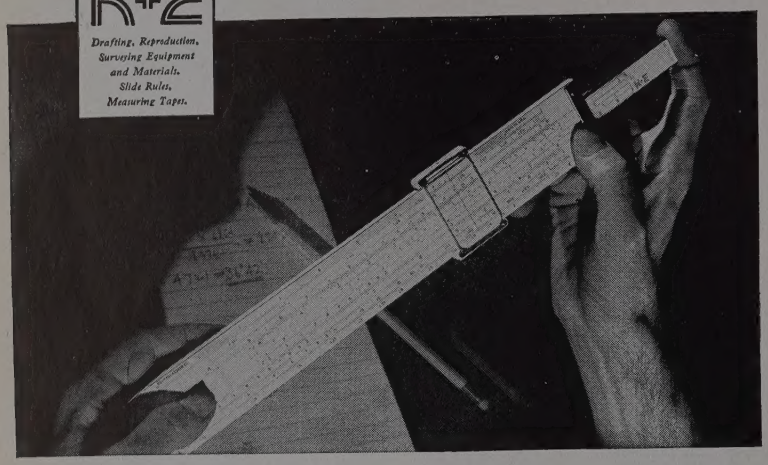

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ON THE CORNER OF WRIGHT AND GREEN

DEAN ENGER RETIRES . . .

(Continued from page 13)

has rendered excellent service on many state and national committees.

His service has been recognized by several noted biographies such as Who's Who in America, and the American Man of Science.

On the twelfth day of July, 1948, Dean Enger was recognized by the University as being "King for a Day." For the first time in his life he was a University president. He attained the position of president because all of the University officials, of higher priority than himself, were out of town. Since he was the oldest dean on the campus, he was informed that he would have to take over. Everything went along smoothly according to Dean Enger and nothing but routine matters concerning the College of Engineering were presented to him. He had even forgotten that he was holding the University's top position. Provost Coleman R. Griffith relieved him of his duty the following day.

Dean Enger has earned a rest; and he expects to take one this fall. He enjoys his summer trips by automobile and has traveled throughout the United States and Canada. In 1939, he toured the Baltic Sea nations in Europe. For recreation, he likes an occasional game of golf.

Dean Enger was born in Decorah, Iowa, on May 5, 1881, and he married Mary Crawford on August 24, 1908. They have two children, a boy and a girl, both graduates of the University of Illinois. Bertha Marie Enger graduated in 1932 from the school of journalism and married Henry Molden, former sports editor of the Daily Illini. Mr. Molden is now on the sports staff of the Omaha World Herald. Walter M. Enger graduated from the College of Engineering in 1935 and has been employed on a major dam project near Redding, California.

Dean Enger and his wife have been residing in their new home at 606 West Delaware since 1940. It is of modern brick veneer and follows the Georgian style of architecture.

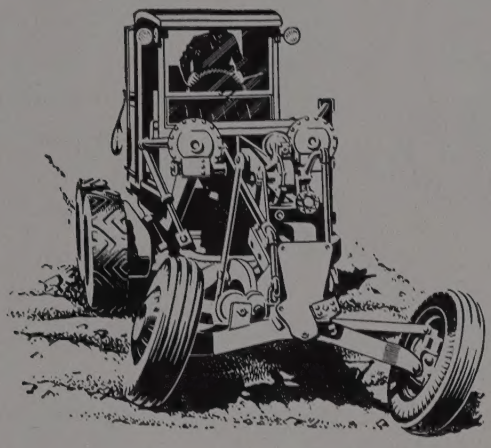
Answers to Vocabulary Clinic

1-b, 2-c, 3-a, 4-a, 5-b, 6-a, 7-c, 8-b, 9-d, 10-b, 11-d, 12-a, 13-a, 14-a, 15-a.

Good judgment comes from experience, and experience—well, that comes from poor judgment.—S. B. Buckner.

The more intellectual people are, the most originality they see in other men. To commonplace people, all men are much alike.—Pascal.

Another page for **YOUR BEARING NOTEBOOK**



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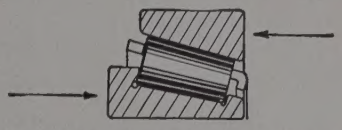
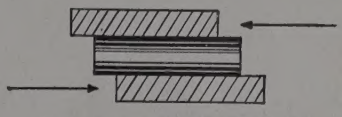
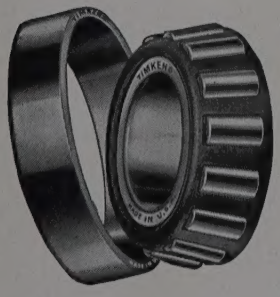


TIMKEN® TAPERED ROLLER BEARINGS



STRAIGHT ROLLER BEARINGS



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A Scot was leaving on a business trip, and he called back as he was leaving, "Goodbye, all and dinna forget to take little Donald's glasses off when he isn't looking at anything."

* * *

"Were you excited when you first asked your husband for money?"

"Oh, no, I was calm—and collected."

* * *

1st Prisoner: "What are you in for?"

2nd Prisoner: "Want to be a warden, so I thought I'd start from the bottom."

* * *

"Just look at old Phillips over there—thoroughly enjoying himself' And I've always understood he was a woman-hater."

"So he is; but she's not with him tonight."

* * *

He: "Who spilled mustard on this waffle, dear?"

She: "Oh, John! How could you? This is lemon pie!"

* * *

Visitor: "And what's your name, my good man?"

Prisoner: "974238."

Visitor: "Is that your real name?"

Prisoner: "Naw, dat's just me pen name."

* * *

"Whaddya mean, she's a drug addict?"

"Usually under the influence of some dope."

* * *

He was sitting at the bar, downing one after another and laughing boisterously. Every so often, as he mumbled to himself, he would hold up his hand in protest. Finally the bartender's curiosity got the better of him.

"What are you doing?" he asked. "I'm telling myself jokes," was the reply. "But why the hand in the air?" "Oh, that's when I stop me if I've heard it before."

Mary had a littele dress
A dainty one and airy,
It didn't show the dirt a bit
But, wow, how it showed Mary!

* * *

She: Oh darling, the baby swallowed the matches. What will we do?

He: Here, use my cigarette lighter.

* * *

"I was a spy."

"Did they shoot you?"

"I don't know. I was blindfolded."

* * *

"Tell me, is this good perfume?"

"It's one of our best smellers."

* * *

"They say bread contains alcohol."

"That so? Let's drink a little toast."

"Doesn't your wife miss you when you stay out till three in the morning?"

"Occasionally—but usually her aim is perfect."

* * *

1st Coed: "Give me a man with a past. A man with a past is always interesting."

2nd Coed: "That's true; but I don't think he's nearly as interesting as a man with a future."

3rd Same: "I like a man with a present."

* * *

"Doesn't that soprano have a large repertoire?"

"Yes, and that dress she has on makes it look worse."

* * *

"Broken off your engagement to Mary?"

"She wouldn't have me."

"You told her about your rich uncle?"

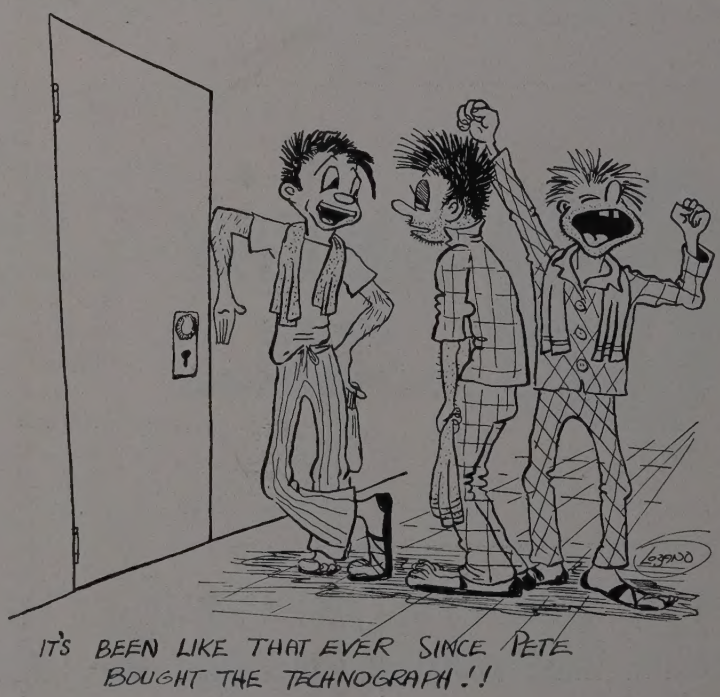
"Yes. She's my aunt now."

* * *

Judge: "And what did you do when you heard the accused using such awful language?"

Policeman: "I told him he wasn't fit to be among decent people, and brought him here."

* * *

Employer: "What do you mean by telling me that you had seven years experience in a bank when you never held a job before?"

College Grad.: "Well, you advertised for a man with imagination."